1953-1954
Vol. 31
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MODERN PLASTICS

SCIENCE & TECHNOLOGY

CANCELLED 69

SEPTEMBER 1953

Foundries are proving that

A lot of machining is needless

...another case where Durez produced the right answer in RESINS

● A revolution in casting methods now under way in the nation's foundries is destined to save millions in manufacturing costs.

With the new method, metal castings produced in Durez resin bonded shell molds conform to required dimensions very closely, and have such smooth surfaces that in some cases machining is eliminated completely. One large casting that formerly required 27 pounds of metal removal per piece now needs less than three.

Success depends largely on the bonding resins. Working with leading foundries from the start, Durez has perfected a phenolic resin with exceptionally fast cure and rigid set. The resin facilitates mass production and makes it easier to obtain castings with desired qualities of structure, dimensional accuracy, and finish.

This is one way in which Durez — leading specialists in phenolics — has contributed through research to industrial advance. Others are in the fields of abrasives, rubber, wood waste utilization, paper products, printing inks, wax emulsions, and of course, plastic molding compounds.

If you have a product or process that may call for the mechanical, chemical, and electrical values inherent in phenolics, why not talk things over with men who specialize in them? Our experience is at your service.

Our monthly "Durez Plastics News" will keep you informed on industry's uses of Durez. Write, on office letterhead.

DUREZ PLASTICS & CHEMICALS, INC.
1209 Walck Road, North Tonawanda, N. Y.

PHENOLIC PLASTICS THAT FIT THE JOB

This is the new

Duosonic *Capri*

PORTABLE PHONOGRAPH*

—*Its all-plastic case scores another FIRST for* *Catalin Styrene*

Pounds lighter, and as catchingly color-toned as a popular new tune, "Capri" is Duosonic's latest ALL-PLASTIC, 3-speed phonograph sensation. Pioneered flawlessly in molded CATALIN STYRENE, *the gem of plastics,* this smartly designed housing is no larger than a small radio! "Capri", an entertaining, happily priced source of *portable* enjoyment—is something you can take with you!

CATALIN STYRENE is no stranger among successful all-plastic FIRSTS! Its molding properties are unexcelled and all-embracing. Its versatile processing ability serves to inspire new design and new application. In the fields of radio, giftwares, toys, housewares and *now,* long-playing phonographs, it is the material of *long-selling* champions! So, when incentive moves you to sponsor a plastic leader, begin by specifying CATALIN STYRENE.

* Molded by Majestic Molded Products, Inc., Bronx, N. Y. for Sonic Industries, Inc., L.I.C., New York

CATALIN CORPORATION OF AMERICA
ONE PARK AVENUE • NEW YORK 16, N. Y.

CATALIN

In addition to Styrene Molding Compounds, Catalin chemical products include a wide range of Urea, Phenolic, Cresylic, Resorcinol, Melamine and Styrene Resin formulations.

MODERN PLASTICS*

SEPTEMBER 1953 VOL. 31, NO. 1

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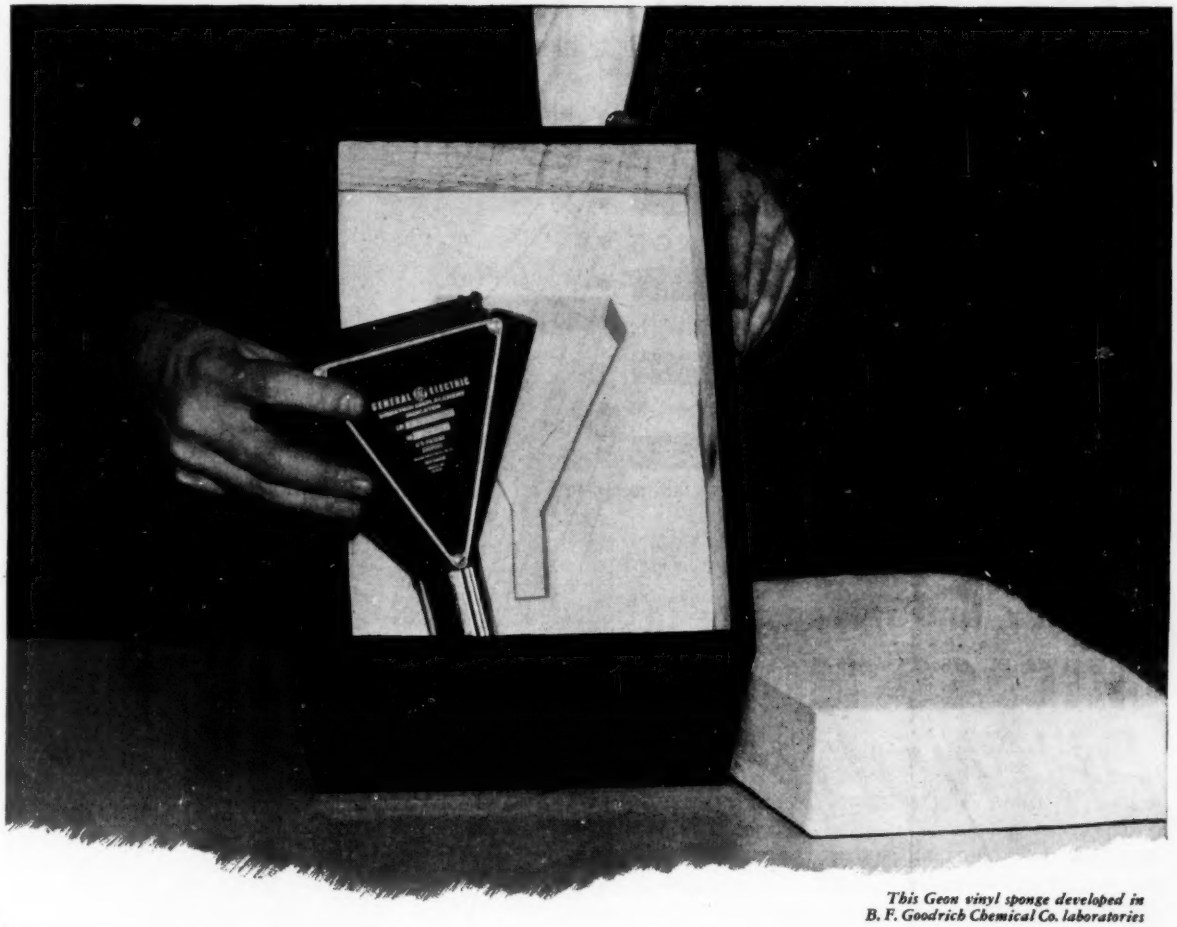
DEPARTMENTS

Modern Plastics, published monthly by Breskin Publications, Inc., at Emmett St., Bristol, Conn. Executive and Editorial Office: 575 Madison Ave., New York 22, N. Y. Entered as second class matter at the Post Office at Bristol, Conn., December 14, 1950, under the Act of March 3, 1879. Modern Plastics copyright 1953 by Breskin Publications, Inc. All rights reserved. Nothing that appears in Modern Plastics may be reprinted wholly or in part without first securing special permission. Modern Plastics is regularly indexed in Industrial Arts Index and Industex. Subscription $6.00 a year, $11.00 for two years, $15.00 for three years in the U.S., its possessions, South America, and Canada. All other countries $12.00 a year, $20.00 for two years, $28.00 for three years, payable in U.S. currency. Price of this issue 75 cents per copy in the U.S., its possessions, South America, and Canada; all other countries $1.25. Printed in the U.S.A. by the Hildreth Press, Inc., Bristol, Conn.

*Reg. U.S. Pat. Office

Another new development using

B. F. Goodrich Chemical *raw materials*



This Geon vinyl sponge developed in B. F. Goodrich Chemical Co. laboratories

How to pack a Fragile Baby!

THE cost of damage to electronic or other sensitive instruments in shipping is high, so that special packaging is needed to guard against such injury. See how well this new Geon vinyl sponge does the job!

It can be molded to fit the shape, for exact and firm "holding". Then, with a top layer of the sponge, the instrument is completely and safely covered. No extra wrapping is needed.

Because this Geon vinyl sponge is resilient and shock-resistant, it cushions instruments against damaging bumps and jars. And because the sponge is made of Geon, it also resists aging, alkalis, oils, greases and many chemicals. A material that has wide possibilities for packaging optical instruments, electrical equipment and other fragile objects!

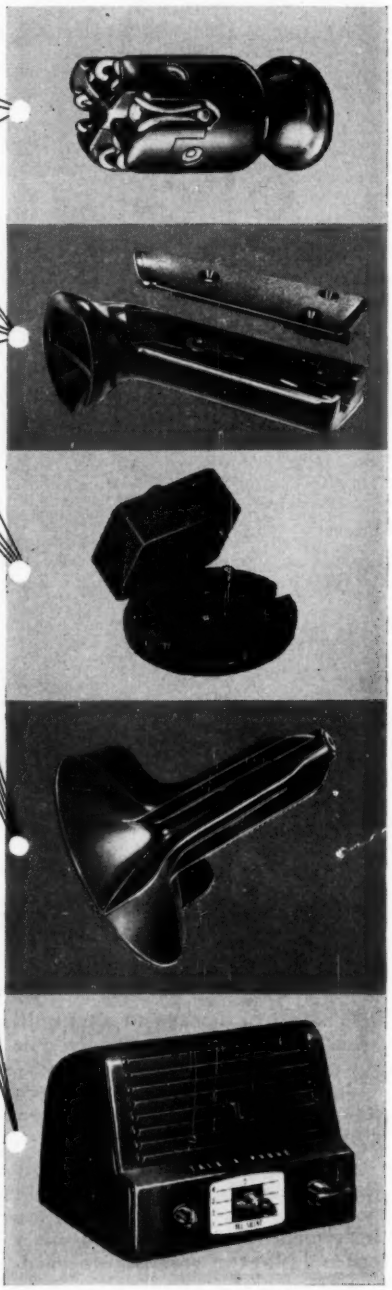
Perhaps this use of Geon may start you thinking how a Geon material—resin, plastic granules or latex—may help you solve a problem, develop or improve more saleable products. We'll help with technical advice, aid you in selecting the Geon material best suited to your needs. For information, please write Dept. GB-9, B. F. Goodrich Chemical Company, Rose Bldg., Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

GEON RESINS • GOOD-RITE PLASTICIZERS . . . the ideal team to make products easier, better and more saleable.

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON colors

What Combination *does your product call for?*

IMPACT STRENGTH
STRUCTURAL STRENGTH
HEAT RESISTANCE
MOISTURE RESISTANCE
ALKALI RESISTANCE
ELECTRICAL INSULATION
MINIMUM WEIGHT
DIMENSIONAL STABILITY
SMOOTH SURFACES
LASTING FINISH



You may find the answer in
CHICAGO MOLDED *PHENOLICS*

Of course, no single material will give you all these qualities. But among the various formulations of phenolics and fillers are these important advantages, either singly or in combination. That's why this tried and proven material is still the most widely used of all plastics for hundreds of well-known applications.

The important thing is to know which of the dozens of phenolic formulations to use . . . and how to be certain of the desired results every time. And that's where we come in. We've been molding phenolics in all their widely varied forms for more than 34 years. We mold all other commercial plastic materials, too. So, all in all, we have accumulated a lot of valuable experience.

A surprisingly large number of the biggest names in industry have taken advantage of this experience . . . and, as a result, come to Chicago Molded year after year for the best in molded plastics. Most of them started by talking things over with a Chicago Molded engineer. You might find this a good idea, too. And there's no obligation whatsoever. Just drop us a line. Or, for fast action, wire or phone.

CHICAGO MOLDED
PRODUCTS CORPORATION

1046 North Kolmar Avenue • Chicago 51, Illinois

CUSTOM MOLDERS OF ALL *Plastics*

Member, Committee on Large Plastics Moldings, SPI

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EDITORIAL

It Could Happen Again!

While plastics gain wider and wider acceptance in applications of industrial and structural nature, serving successfully under extremely punishing conditions, a relatively small scattering of proprietary molders in both the toy and housewares or gadgets fields continues to do great damage to the reputation of the industry as a whole for sound design, honesty of application, and quality of production.

These few molders make products that sell at odd fractions of a dollar through mass merchandising outlets, frequently without benefit of brand, and temporarily prosper while larcenously laughing at attempts of other sections of the industry to upgrade plastics in products and components.

And when a shopper, with a few extra pennies in her purse, picks up and takes home an admittedly attractively shaped and colorful plastics toy and watches it destroyed in a trice by infant muscles, she naturally suspects all plastics and the group of industries that produce them. Same thing happens when she buys a badly engineered and poorly made plastics item for her kitchen.

Technically, from the standpoint of materials and equipment, there is absolutely no reason for injection molded junk to be foisted on the public at any price — even pennies. With the present range of plastics available and at the prices of these materials, adequate impact strength, compression strength, moisture resistance, and dimensional stability are easily obtained. As a matter of fact, it would almost appear as though the styrene alloys (the so-called "impact styrenes"), since they sell for so little over the cost of ordinary styrene, are being used as an excuse for thinning down wall sections and de-beefing some toys and gadget designs.

What will happen in the long run to the perpetrators of these putrid products is inevitable. The same thing happened to a like lot only seven short years ago. Remember?

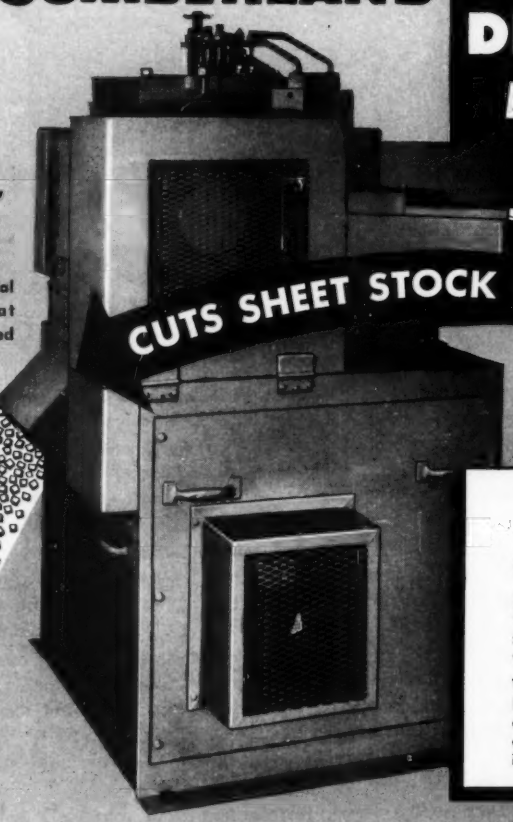
In 1946 a lot of small plastics toys, plastics premiums, and plastics gadgets backed up in the channels of distribution and just about wrecked the companies that made them, while doing great public relations and sales damage to makers of good plastics products and to the industry as a whole. And in that year literally hundreds of molds were taken out of use and were replaced by molds designed to make products that would stand up to normal use, that gave good value, and that reflected well the industry's attitude toward quality.

And not until many months after that was done were plastics toys and housewares generally again acceptable to retail buyers and to the public.

The responsibility rests not with the public, not with the distributors, not with material makers, and not with the industry. It rests squarely on the shoulders of a few men who through ignorance or cupidity insist on an unfair present profit regardless of the probable effect of their actions on the future of themselves or anyone else. We hope these few will soon remember — and will take steps to prevent history from being repeated.

NEW CUMBERLAND "STAIR-STEP" DICING METHOD

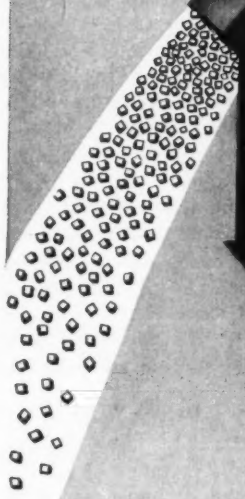
Dices FULL RANGE of Plastic Materials!



"STAIR-STEP" DICING MACHINE

Plastic sheet material enters machine at right and is processed into cubes below.

CUTS SHEET STOCK INTO UNIFORM CUBES!



Now You Can Choose From TWO Cumberland Dicing Methods

NEW "STAIR-STEP" METHOD is the "universal" dicing method. It dices the *full range* of plastic materials having widely varying physical properties.

WELL-KNOWN "NOTCHED-KNIFE" METHOD dices vinyl materials of medium plasticizer content, vinylidene chloride, and other materials having suitable physical properties.

NOTCHED-KNIFE DICING MACHINE

Cumberland's "Stair-Step" dicing method offers you a *completely new* method of dicing. Perfect cubes are cut from sheet stock in one shearing action! All sides of cubes are cut cleanly. Cubes or rectangular pellets may be produced in various sizes (1/16" to 1/2") by simply changing knives.

WRITE FOR COMPLETE INFORMATION!

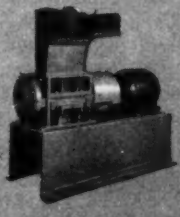
This new dicing principle makes it possible to dice the *full range* of plastic materials, including polyethylene, vinyl, acetate, and nylon. Two standard machine sizes accommodate sheets up to 7" or 14" wide. Machines to handle greater widths specially built.

CUMBERLAND MANUFACTURES A COMPLETE LINE OF PLASTICS REDUCING MACHINES

Designed Specifically for Plastics . . . . To Give You Maximum Operating Efficiency and Economy

GRANULATING MACHINES (All Models)

Eight different models, direct coupled and V-belt driven, are available to meet your requirements. For complete details, request Bulletin 251.



20" ALL-STEEL GRANULATOR

Rugged machine for granulating large "difficult-to-process" plastic parts. Eliminates prior band-sawing. 8" x 20" throat opening.

PREBREAKER

Cuts up refrigerator panels, radio, television cabinets, polyethylene bottles and containers. Available with 20" x 32" or 10" x 24" throat opening.

CUMBERLAND Engineering Company Inc.

BUILDERS OF BETTER MACHINES FOR THE PLASTICS INDUSTRY

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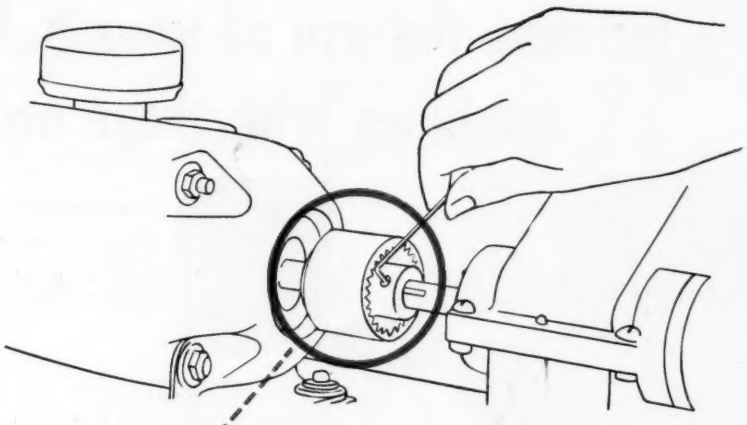
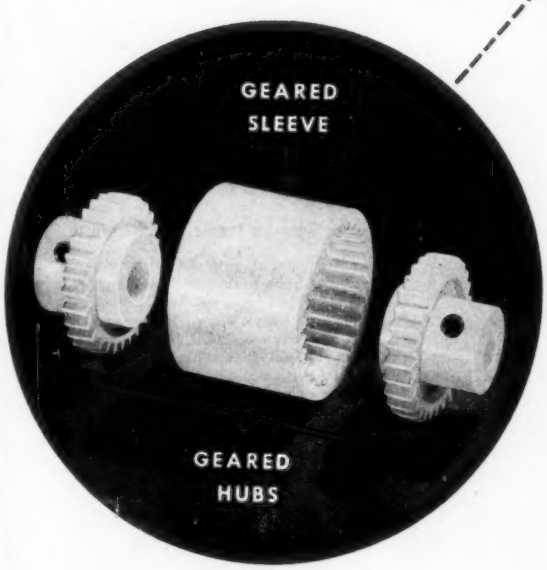


Couplings of resilient DU PONT NYLON plastic



Couplings molded for
John Waldron Corporation,
New Brunswick, N. J.,
by Pyro Plastics, Union, N. J.

. . . run quietly at high speeds without oiling . . . resist wear . . . don't corrode

Severe operating conditions often cause excessive maintenance on small flexible gear couplings used to connect fractional horsepower motors and driven equipment—such as pumps and generators. Shaft misalignment results in noisy operation and excessive wear. Under certain conditions abrasion and corrosive attack can severely shorten service life.

The John Waldron Corporation has now developed an improved gear coupling that overcomes these problems. In this design, the three components—the internally geared "sleeve" and two externally geared "hubs"—are molded of Du Pont nylon plastic—one of the Du Pont family of plastic engineering materials.

Du Pont nylon is resilient. It damps noise and vibration . . . absorbs shock loads . . . assures quiet operation. Du Pont nylon is strong, tough, durable . . . resists wear and abrasion often with little or no lubrication. (Couplings operated without lubrication for over 18 months showed no appreciable wear). Du Pont nylon is unaffected by water, oils, most common chemicals . . . is not subject to rust or electrolytic corrosion. Du Pont nylon will operate continuously to 250°F. It provides electrical insulation. And parts of Du Pont nylon can be economically mass-produced by rapid injection molding—cutting production steps and costs.

This is another of the hundreds of examples where Du Pont nylon plastic is contributing to improved performance in industrial parts. Perhaps it can be of value to you. For full information, write: E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room 309 Du Pont Bldg., Wilmington 98, Delaware.

DU PONT
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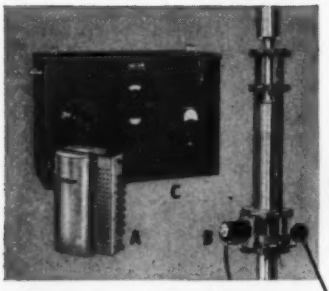
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY
Polychemicals
DEPARTMENT
PLASTICS • CHEMICALS

Increase the use of your Baldwin Testing machines with these accessories



High Temperature Testing Equipment

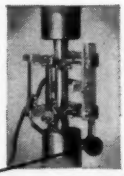
Includes *electric furnace* (A), *high temperature extensometer* (B), and *temperature controller* (C) which enable you to test metals at high temperatures. Various models are available for temperatures up to and including 2200° F.

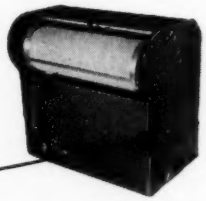
Extension Under Load Indicator

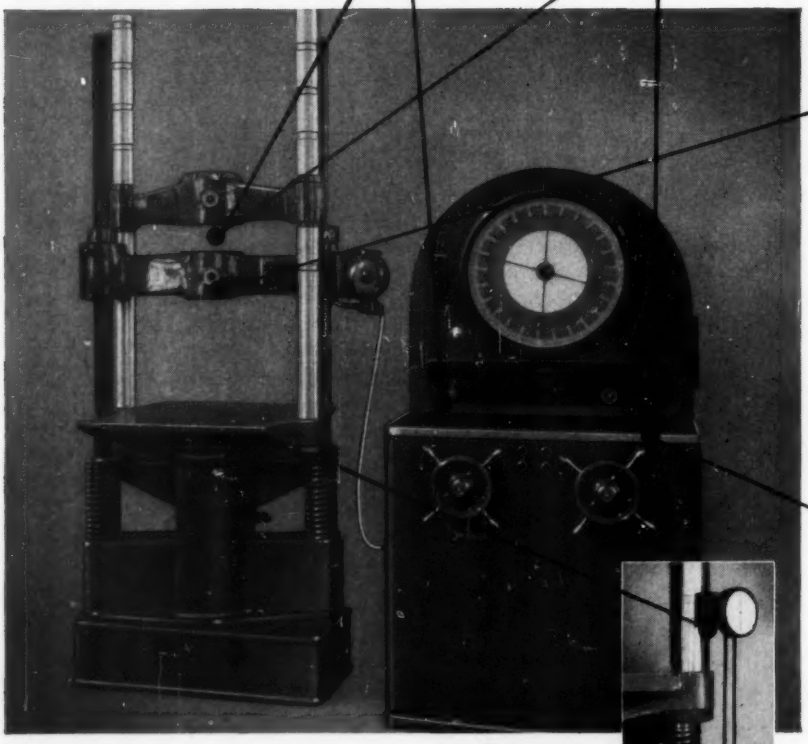
Used with a microformer type extensometer, this indicator will give you both a visual and audible signal at any desired predetermined amount of extension under load (such as 5% of the gage length).

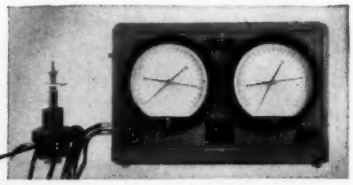
SR-4 Extensometer and Strain Gage Recorder

This records on a chart a load-elongation graph for determining the elastic and plastic properties of materials. Various types are available.



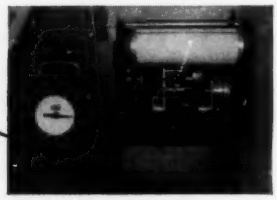






Air Cell (with Bourdon tube-type indicators)

Inserted in the grip slot and arranged to work with the testing machine indicator or a portable indicator, the Air Cell extends the precision ranges down to one pound full scale on any machine. This permits testing of light materials such as plastics, textiles, wood, foils, fibers, etc. with machines intended for higher capacities. (Bulletin 264.)



Strain Rate Pacer

(Shown with Microformer Recorder.) This device enables you to maintain percisely a constant straining rate of the test specimen gage length during the loading of the test specimen. Standard pacing speeds from .00025 to .25 inch per minute are available.

Ram Pacer

This controls ram speed at desired rate (8 pacing speeds, from 0.01 to 1.0 inch per minute). Enables you to meet test specifications. High magnification types for infinitely variable speeds from 0.002 to 4.0 inches per minute also available.

BULLETIN 261-A, a 12 page booklet, illustrates and describes fully Baldwin's line of grips, accessories and auxiliary equipment. Write Dept. 2326, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pennsylvania.

BALDWIN BLH LIMA-HAMILTON

TESTING HEADQUARTERS

BALDWIN-LIMA-HAMILTON

Philadelphia 42, Pa. • Offices in Principal Cities

Coast to Coast

Celanese Technical Service for MARCO† RESINS

Applications

Marco low pressure thermosetting resins are now being produced by Celanese—in greater volume to meet current demands, and to give manufacturers and molders a solid basis for long range planning.

Matching this expanded production is a sales and technical service organization with offices in principal U. S. cities—ready to provide immediate help on problems of applications, molding and fabricating procedures, and formulation selection.

You are invited to get in touch with Celanese representatives in Los Angeles, San Francisco, Dallas, St. Louis, Chicago, Cleveland, New York, Atlanta, Georgia and Leominster, Mass. In Canada, 185 Bay Street, Toronto. Or, if you wish, fill out and return the coupon on this page. Celanese Corporation of America, Plastics Division, Marco Products Dept. 101-I, 1711 Elizabeth Ave. West, Linden, New Jersey.

Celanese

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1711 Elizabeth Avenue West, Linden, New Jersey.

- ☐ Laminating
- ☐ Low Pressure molding
- ☐ Coating
- ☐ Impregnating
- ☐ Casting

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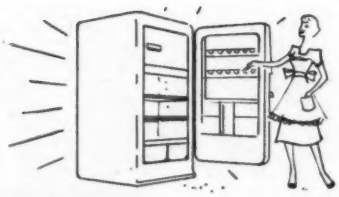
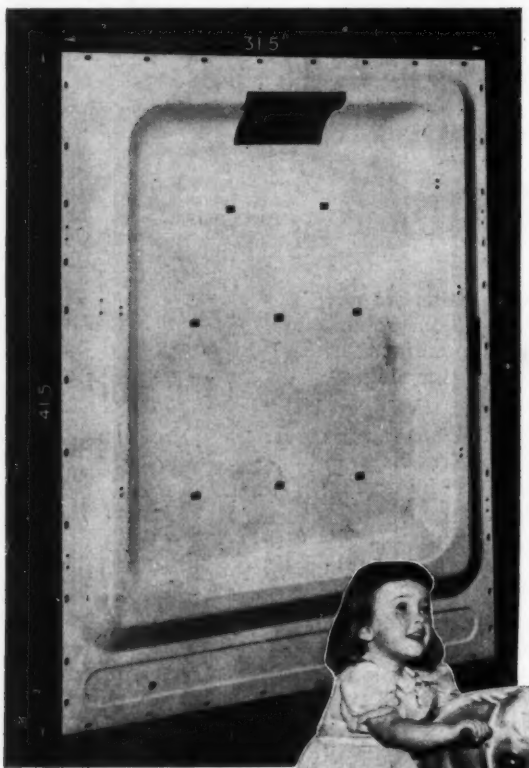
Your company_____

Address_____ Telephone Number_____

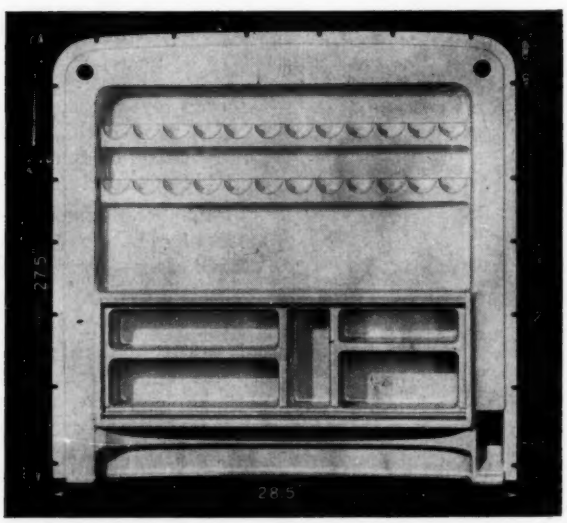
Your manufacturing interest_____



REED-PRENTICE PROVE EXTRA CAPACITY



1272 sq. in. panel for Westinghouse refrigerator molded on Reed-Prentice 1500-T injection machine by General Machine and Tool Works of Walled Lake, Michigan, weighs 100 oz. Uniform thickness for perfect fit is important on this large piece.

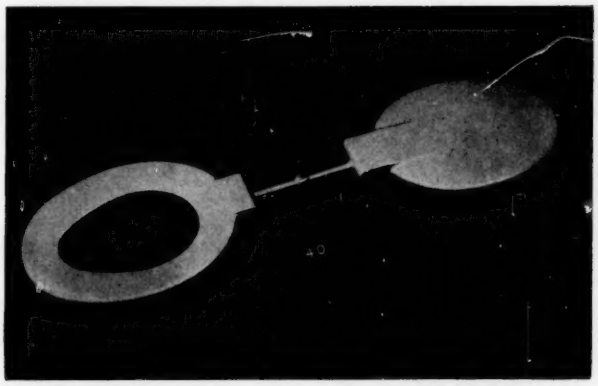


99 oz. International Harvester refrigerator section molded on 1500-T "REED" by General Machine and Tool Works of Walled Lake, Michigan, has projected area of 784 sq. in. and requires flash-free molding.

Matching halves of the new plastic Wonder Horse are molded on a 1500-T "REED" in a two-cavity shot weighing 98 oz. and having 700 sq. in. projected area. Ger-Ell Manufacturing Co. of Chicago molds the hobby horse body for the manufacturer, Wonder Products Co., Collierville, Tenn.

"REEDS"—the World's Foremost Machines for EXTRA CAPACITY MOLDING

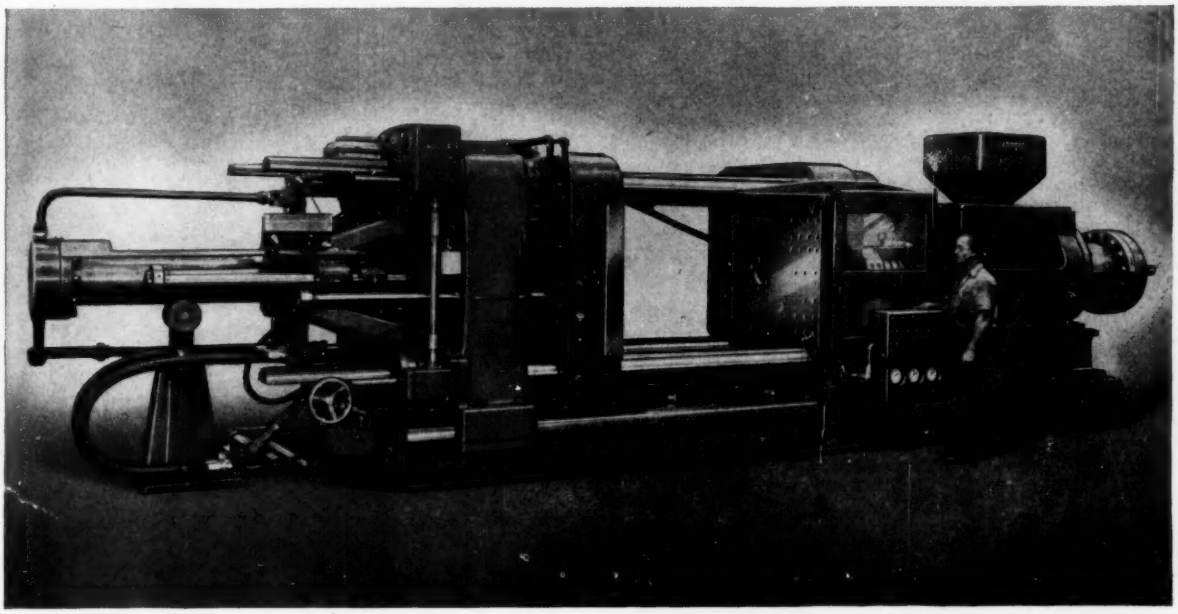
MACHINES MOLDING!



This solid 96 oz. toilet seat and cover are molded of polystyrene without sink marks or blemishes by Ger-Ell Manufacturing Co. of Chicago on a 1500-T Reed-Prentice Injection Molding machine.

Actual die locking pressure of 1500 tons enables Reed-Prentice 1500T-200 & 300 oz. injection molding machines to mold large plastic parts of uniform thickness without blemish or flash.

In refrigerator parts, the hobby horse body and the solid plastic toilet seat and cover — where strength and uniform thickness are essential — 1500-ton "REEDS" have established enviable records for exceptional performance.



If your molding program includes heavy sections with large projected areas, it will pay you to investigate the 1500T-200 & 300 oz. "REED".

SPECIFICATIONS	1500T-200 & 300 oz.
Die locking pressure, tons	1500
Rated casting area, sq. in.	1200
Mold opens (Stroke)	36"
Max. die space	40"
Size of die plates	60" x 72"
Weight, lbs.	106,000

"REEDS" available in 4, 8, 12, 16, 20, 24, 32, 48 and 200 oz. sizes.

REED-PRENTICE CORP.
INJECTION MACHINES
WORCESTER MASS., U.S.A.

BRANCH OFFICES
75 West St., New York 6, N. Y.
1213 West 3rd St., Cleveland 13, Ohio
4001 N. Elston Ave., Chicago 18, Illinois
2842 W. Grand Blvd., Detroit 2, Michigan

MAIN OFFICE
677 Cambridge St., Worcester 4, Mass.

REPRESENTATIVES:
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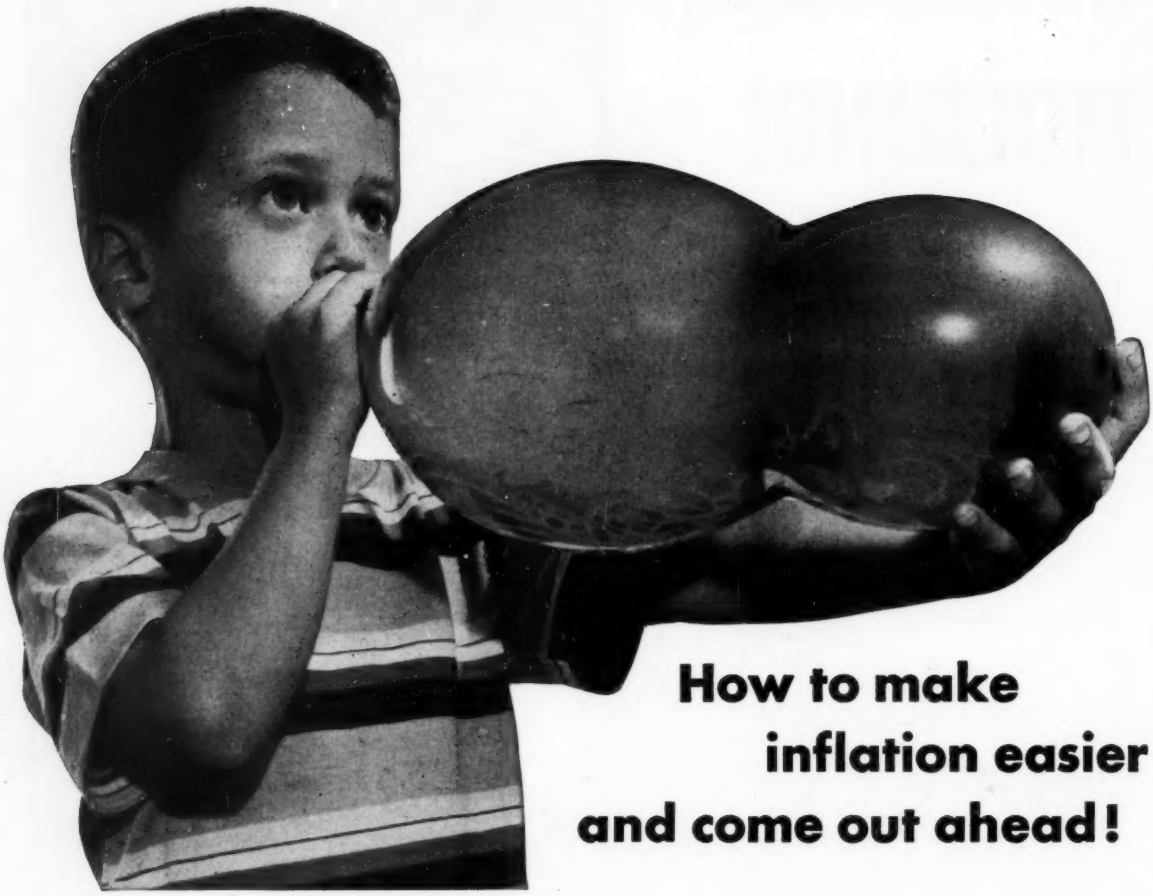
Seattle & Spokane..Star Machinery Co.
Minneapolis.....Chas. W. Stone Co.
Los Angeles. Western Molders Supply Co.

Another new development
using AMERICAN ANODE *materials*



How to make inflation easier and come out ahead!

MOST balloons are hard for youngsters to blow up. Some balloons fail to hold gas well, or "pop" quickly in the sun. A manufacturer who had these sales problems put them up to American Anode.

Anode technicians went to work, analyzed every factor, and came up with a new and superior latex formulation. Now, the balloons are much easier to inflate—require 70 per cent less effort. Gas retention is vastly improved—100 per cent better! Balloons can be blown up farther in advance and stay up much longer.

The new American Anode latex compound also provides excellent resistance to sunlight, which normally causes rapid deterioration. The balloons withstand exposure to sun much longer without popping.

Manufacturing costs are cut, too. Because the new latex compound does not deteriorate in stock, there is uniformity of cure. Scrap is reduced. Production goes faster and easier. And the new compound costs no more than the formerly used material.

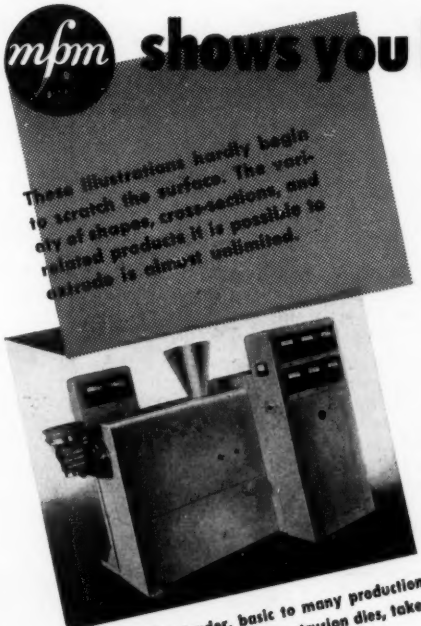
This is a typical example of how American Anode helps manufacturers solve problems and improve products, where latices or plastisols are involved. Perhaps we can help you. For information, please write Dept. AD-5, American Anode, 60 Cherry Street, Akron, Ohio.

AMERICAN ANODE

A Division of The B. F. Goodrich Company

CRUDE AND AMERICAN RUBBER LATICES, WATER CEMENTS AND SUSPENSIONS, AMERAN RESIN PASTES, COMPLETE MANUFACTURING FACILITIES

mpm shows you how to extrude it at a profit

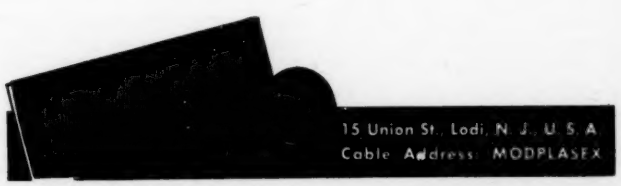


MPM 3½" extruder, basic to many production systems. MPM also supplies extrusion dies, take-offs, and other extrusion equipment.

Many plastics users are astounded at the ease they have had in converting thermoplastic resins into saleable products on MPM extrusion equipment. The common denominators of their success have been the expertly-designed, high-output extrusion equipment MPM has furnished them, and the production know-how they have acquired, often in a matter of hours, by attending test-runs of their equipment at the MPM plant located close to New York City.

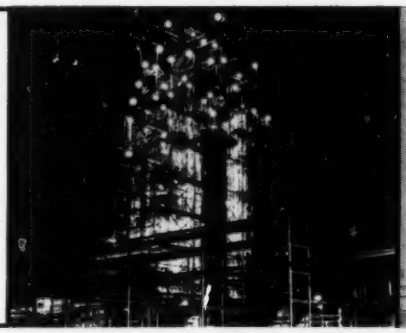
At the test-run of your machines, your employees will learn what speeds, temperatures, and procedures they must follow in order to extrude the product or products you have selected. When your equipment is delivered, it can be placed in production merely by connecting it to water and electricity.

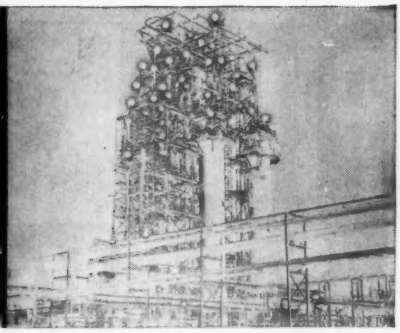
MODERN PLASTIC MACHINERY CORP. will promptly quote prices and delivery on complete equipment for extruding what you want. For full information, outline your production requirements in a letter today.

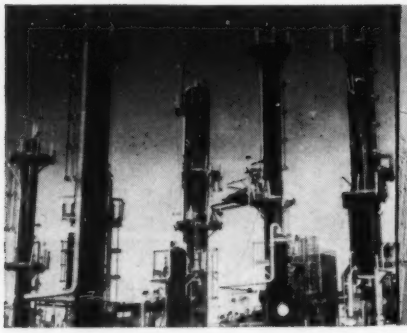


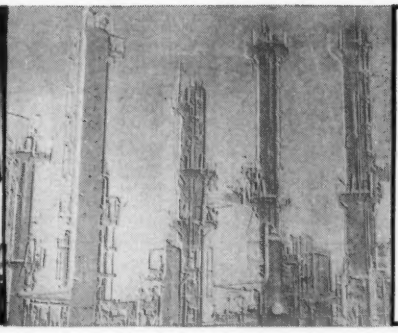
(West Coast Representative)
4113 W. Jefferson St., Los Angeles 16, Calif.

From the Monomer Headquarters of America



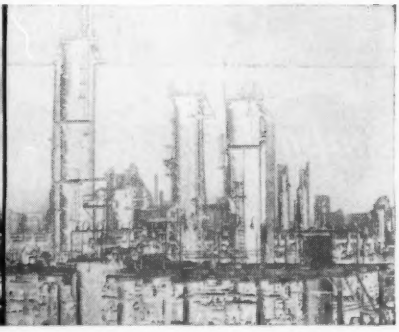






STYRENE
ACRYLONITRILE
VINYL CHLORIDE

Starting Points for New, Profitable Products



If you are equipped for product research, explore Monsanto's monomers for new product development.

These low-cost reactive compounds are readily available for the development of scores of new products or product improvements.

EXAMPLE: Ask yourself: "What could styrene do for asphalt?"—Styrene is a powerful solvent and aided by catalysts will polymerize in a variety of mixtures. Styrene in roofing or paving compositions will act as a solvent, permitting cold mixes . . . then with suitable catalysts the mixture may polymerize in place into a longer-wearing composition. If you use or process asphalt compositions, here's a possibility worth exploring.

This is only one idea . . . there are dozens more suited to your own special field. Monsanto's monomers can be your starting points for new copolymer resins, special coatings and extrusion compounds. They can act as short cuts to organic syntheses. Try Monsanto monomers yourself by writing for laboratory samples. For more information on these products, write **MONSANTO CHEMICAL COMPANY, TEXAS DIVISION, TEXAS CITY, TEXAS.**

OTHER TEXAS DIVISION ADVANTAGES:

TOP QUALITY . . . *all monomers are highest purity, produced in industry's most modern plants, under strict quality control.*

"TIMED SHIPMENTS" . . . *deliveries synchronized with your production from five strategically located shipping points. This system can release valuable tank storage space for other use.*

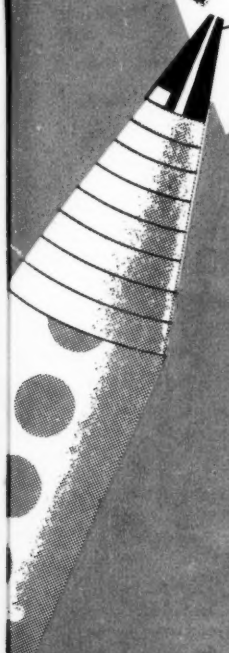
TECHNICAL SERVICE . . . *on storing, handling, inhibiting, analytical procedures, specifications.*

MONSANTO
CHEMICALS AND PLASTICS

SERVING INDUSTRY...WHICH SERVES MANKIND

Check List
FOR BUYERS OF MOLDED PLASTICS

✓	product design service		skilled engineering assistance
✓	precision moldmaking		adequate production facilities
✓	fabricating & decorating		uncompromising reliability
✓	careful inspection		fast truck deliveries



ANY COMPANY which is currently purchasing custom molding from us will be able to check off every box. Ideal Plastics scores high because we bring our customers one of the most comprehensive custom injection molding services in existence.

A trip through Ideal's gigantic plant (over 500,000 square feet) is a revelation in how modern production methods are applied to plastics manufacture. There is row-on-row of high-speed injection presses, more moldmaking equipment than most moldmakers operate, and scores of conveyor lines where competent operators do fabricating, assembling and decorating, and where critical inspectors keep a constant check on quality.

To these you can add the many engineers, designers, laboratory technicians, color matchers and other essential personnel who work in behalf of our customers. This vast, capable staff and abundance of fine equipment makes Ideal one of your best bets for custom molding.

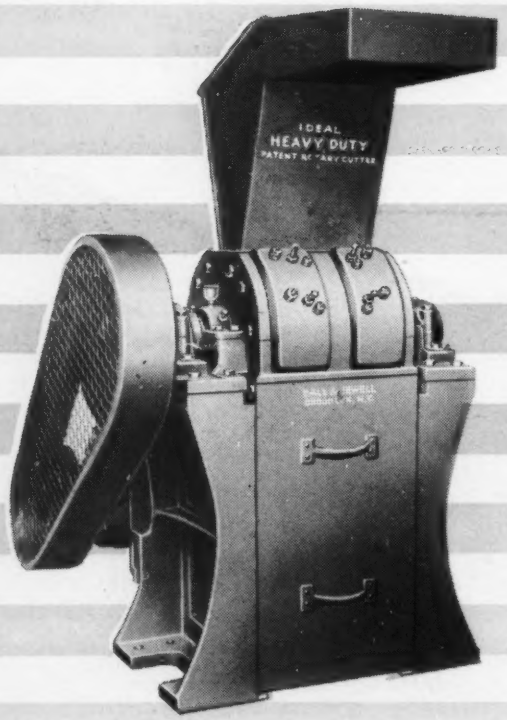
Mr. A. C. Manovill, Vice President in Charge of Sales, will gladly discuss any aspect of your molding problems. Write to him at IDEAL PLASTICS CORPORATION, 184-10 Jamaica Avenue, Hollis 7, N. Y. Phone: AXtel 7-7700. Midwest Representative, Steel Mill Products Co., 176 West Adams Street, Chicago 3, Ill. Phone: CEntral 6-5136.

Better Molded Plastics **Ideal** *for Industry & Home*

where a heavy duty, medium capacity Granulator is needed

HEAVY DUTY IDEAL

GRANULATES UP TO 250 LBS. AN HOUR OF TOUGH DENSE MATERIAL

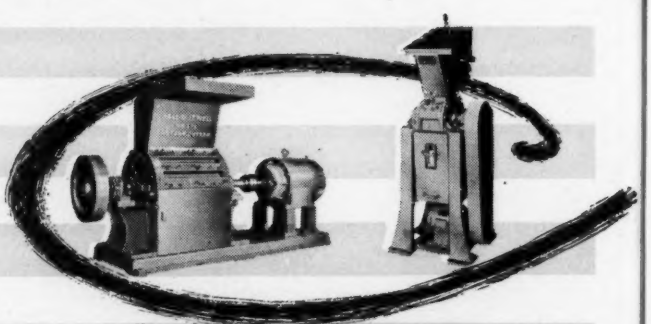


For virgin slabs and accumulated scrap of the toughest materials as well as small bleeder scrap you won't find a better machine than the B & J Heavy Duty Ideal.

The B & J Heavy Ideal will granulate up to 250 lbs. an hour with the greatest of ease. The large 3½" x 10" throat opening is sufficient to handle most scrap. The Heavy Duty Ideal is powered by a 5 H.P. motor.

Where a larger throat opening is needed, the Heavy Duty Ideal Model 351 with a 6" x 10" throat opening is the perfect machine.

In the B & J line, there is a granulator to meet every need. Tell us your requirements and send samples of your material for grinding in our testing laboratory. Or, write for brochure.



One of our larger machines — No. 1½—Capacity up to 1200 lbs. an hour. 15, 20 or 25 H.P. motor

Our Smallest Machine — MIDGET—capacity up to 75 lbs. an hour, 1 or 1½ H.P.

REMEMBER! B&J GRINDERS ARE BUILT TO LAST LONGER!

BALL & JEWELL, INC.

22 FRANKLIN STREET EVergreen 9-6580 BROOKLYN 22, NEW YORK

thermosetting plastics a *Question Mark* to you?

HERE'S A WELL-KNOWN *Answer Mark!*

It's a mould mark—ours. And it's a sign of good source for thousands of manufacturers who use moulded plastic parts.

Here are our qualifications for *your* thermosetting assignments: 1) 36 years' *experience* as planners and moulders in plastics; 2) *specialization* in thermosetting standard materials or new ones like Teflon and glass reinforced moulding compounds; 3) enviable skill in *design* for compression, transfer and plunger moulding methods; 4) *capacity* for production-schedule delivery.

There's a fifth qualification we think is worth mentioning. We're not too proud to recommend specialists in *other* moulding methods if a review of your job suggests it. Will you phone or write us—or one of our offices?

Kurz-Kasch, Inc. • 1415 S. Broadway • Dayton 1, Ohio

BRANCH SALES OFFICES: New York, Lexington, 2-6677 • Rochester, Hillside 4352 • Chicago, Merrimac 7-1830 • Detroit, Trinity 3-7050 • Philadelphia, Hilltop 6-6472 • Dallas, Logan 1970 • Los Angeles, Richmond 7-5384 • St. Louis, Delmar 9577 • Toronto, Elgin 4167
EXPORT OFFICE: 89 Broad Street, New York City, Bowling Green 9-7751.

Kurz-Kasch
FOR OVER 36 YEARS PLANNERS AND MOULDERS IN PLASTICS

DAKE PRESSES

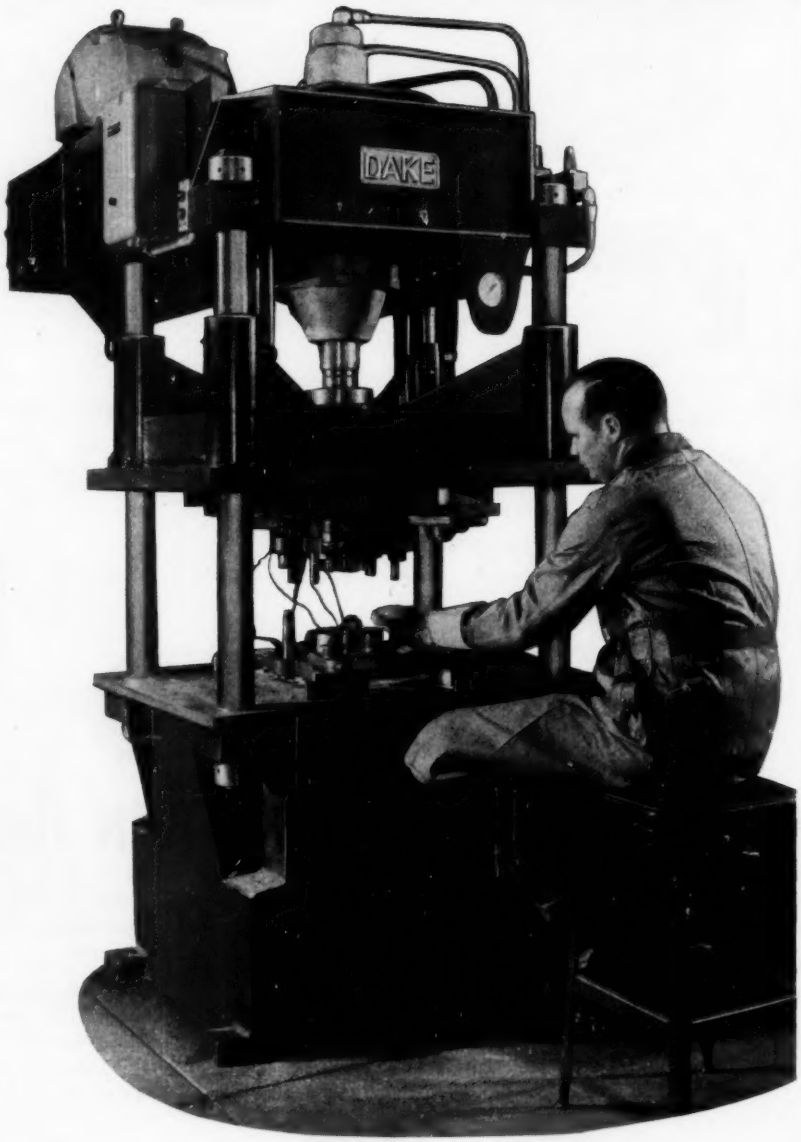
for compression molding reinforced plastics

Dake Plastics Presses are engineered by men experienced in the plastics industry who can help you meet special needs and requirements, as well as provide better equipment for ordinary molding.

Standard models are electric-hydraulic in operation, with capacities ranging from 25 to 300 tons. They are adjustable for stroke, pressure, temperature, and timing of the cure.

The operation is started by pressing dual palm switches (for safety), and is automatic through the entire curing cycle and return of the platen to starting position.

Other presses with simpler controls and less automatic operation are also available. Send for Bulletin #273, and tell us your special requirements.



Dake Engine Company, 648 Seventh St., Grand Haven, Mich.

DAKE PRESSES


Arbor Presses


Hand-Operated Hydraulic


Power-Operated Hydraulic


Guided Platen


Gap Type Presses


Movable Frame


MUEHLSTEIN
VIRGIN POLYSTYRENE
As exclusive distributors for Fostarene—
Muehlstein offers you a dependable source
for quality Virgin Polystyrene. Our experienced
technicians and nation-wide sales organization
stand ready to serve you.
MUEHLSTEIN
REPROCESSED PLASTICS
If you sell plastic scrap . . . use reprocessed
plastics or have your scrap reprocessed—look
to Muehlstein for reliable service. Our complete
laboratory facilities and technical staff assure
satisfaction, especially with color problems.
H. MUEHLSTEIN & CO. INC.
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BRANCH OFFICES: Akron • Chicago • Boston • Los Angeles • Memphis
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Photos courtesy of: Bakelite Co. & Durez Plastics & Chemicals, Inc.

Metasap* Stearates

provide

superior lubricants in molding compounds

If you must meet competition with quality molded products, and yet keep a tight rein on costs, you'll find no greater aid to profitable production than Metasap Stearates.

These metallic soaps provide outstanding lubrication—whether incorporated into molding compounds or dusted onto surfaces of mold cavities. Using them, you will eliminate preform delamination and breakage of finished products, *because ejection pressures will be reduced to a minimum.*

We particularly recommend:

Metasap Zinc Stearate
Metasap Calcium Stearate

For unusually intricate mold designs, and precision fabrication, this excellent lubrication will prove especially advantageous.

outstanding thickeners for plastisols

If you manufacture plastigels, you'll find Metasap Stearates top-notch gelling agents. Moreover, the *ready availability* of these scientifically prepared metallic soaps and the *basic economy* they afford are factors which help cut production costs—enable you actually to save money without sacrificing quality.

We'll be pleased to supply you with *free* samples of:

Metasap Magnesium Stearate **Metasap Barium Stearate**
Metasap Calcium Stearate **Metasap Aluminum Stearate**

—so that you may select just the thickener, or thickeners, you require for the plastisols you are handling.

*Reg. U. S. Pat. Off.

For complete information, write

METASAP CHEMICAL COMPANY (Dept. M), HARRISON, N. J.

Chicago • Boston • Richmond, Calif. • Cedartown, Ga.

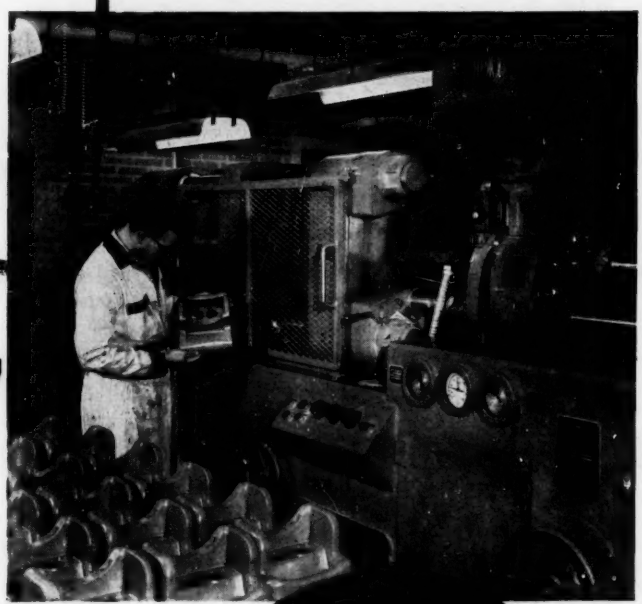
METASAP CHEMICAL COMPANY *REG. U.S. PAT. OFF.

Stearates

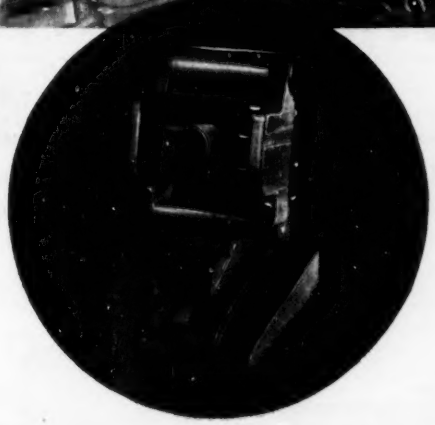
of Calcium • Aluminum • Lead • Magnesium • Zinc

H-P-M 16 oz. at Skyline Industries, Titusville, Pa. molds the housing of the Keystone Visual Survey Telebinocular, a vision-screening testing device used by schools, industries and highway departments.

28 ozs.

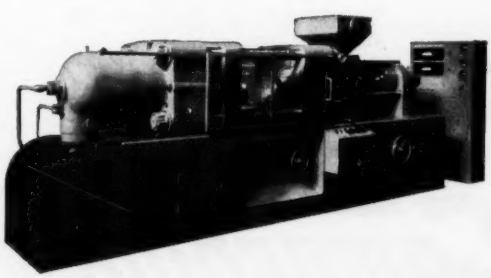


IMPACT "POLY" on an H-P-M 16 OZ!



Talk about BIG shots . . . here's one 75% bigger than the rated capacity of the machine. This 28 oz. polystyrene instrument housing is a typical example of the "plus" capacity built into H-P-M's new 16 oz. injection machine.

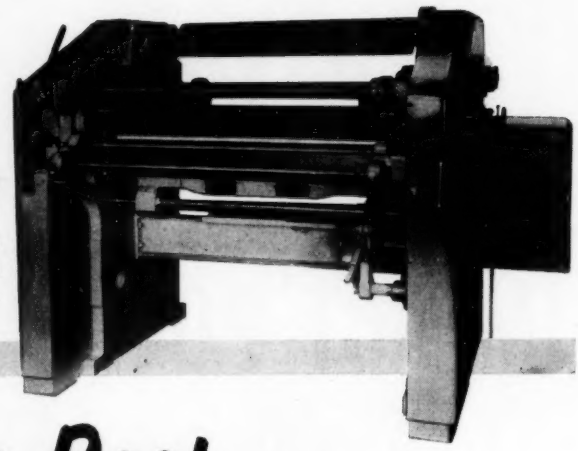
You'll find the new H-P-M "16" has all the outstanding features needed to turn out quality parts of big area . . . complicated sections . . . shallow or deep draw. Regardless of your molding application, whether it be polystyrene or any other thermoplastic, you'll handle the job better and faster with an H-P-M. Write for Bulletin 5204-A today!



HPM

Presses For Every Pressure Processing Application

TYPE 26-R-7 Camachine with razor blade slitting for light gauge plastic film, producing high quality rolls of varying width and diameter at speeds up to 700 fpm.

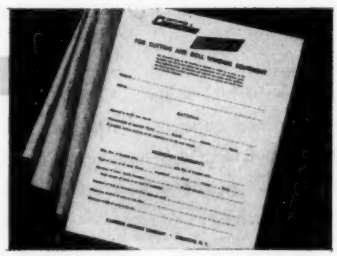


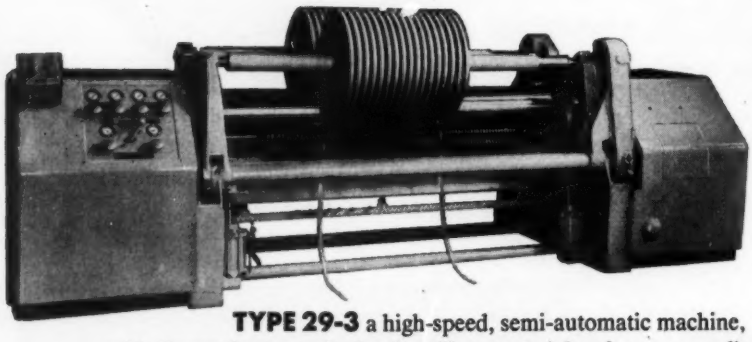
TYPE 26-61PL designed to produce *lightly tensioned* rolls of adhesive coated plastics (and similar materials) to help overcome a tendency toward excessive adhesion of plies in the finished rolls, especially after long storage.

Which Slitter is Best...

FOR YOUR JOB?

There's one easy way to find out which slitter will do the best job for *you*. It will take only a few minutes of your time to use the Camachine Dataform. Then, without cost or obligation, you'll receive an engineered recommendation from Cameron specialists. Here's all you have to do . . .





TYPE 29-3 a high-speed, semi-automatic machine, with finger-tip controls for handling materials of uneven caliper, coated or tacky surfaced at speeds up to 1500 fpm. Versatile in application to many types of materials.

Let Us Know Your Problem-

Answer a few simple questions on the Camachine Dataform. Our engineers can then recommend the most efficient and economical equipment for you. Write today for your free copy of the Camachine Dataform. Do it now.

CAMERON MACHINE COMPANY
61 Poplar Street, Brooklyn 1, N.Y.

Don't wind up with less than a Camachine®

AA-281

The Arab and the Camel

An Arab having loaded his Camel asked him whether he preferred to go up hill or down hill. "Pray, Master," said the Camel dryly, "is the straight way across the plain closed up?" —*Aesop*

To solve production problems... improve product performance...or add sales appeal...Plenco goes straight to the objective.

PLASTICS ENGINEERING COMPANY
Sheboygan, Wisconsin

PLENCO PHENOLICS
FOR BETTER PLASTIC PRODUCTS

It pays to play ball with your molder

Cooperating with your custom molder is the surest way to get moldings that will do their job to perfection. When you supply your molder with everything he needs to know, you put him in the best position to serve you.

Here are a few of the facts a good custom molder insists on knowing: What will the piece be used for? Will it be subject to shock, strain, or unusual conditions? What are the tolerances required? The number of pieces? Will it be assembled with other units? How? Do you expect to be re-ordering next month? Next year? How soon do you need the first delivery? The final delivery?

Let your molder help with the decisions. Don't get cagey. Don't hold back information. Don't change your design every five minutes, particularly after the molds are started.

By playing ball with your molder, you stand to get better moldings at lower cost. And, as countless users of plastics know, there's no molder more willing to play ball with you . . . than Boonton.

BOONTON MOLDING CO.

BOONTON, NEW JERSEY

NEW YORK OFFICE — CHANIN BUILDING, 122 EAST 42ND STREET, MURRAY HILL 6-8540

we CONCENTRATE on YOU

WE have long felt that we could best serve our customers — among molders and allied operators — by directing our efforts towards perfecting our goods and methods to make it almost imperative for designers, planners and engineers to INSIST on checking with Gering when they want . . .

CUSTOM COMPOUNDED THERMOPLASTICS: Polyethylene, Vinyls, Nylon, Acrylic, Cellulose Acetate, Butyrate, Ethyl Cellulose, Polystyrene and its Copolymers. Complete facilities for top quality processing. Full staff of laboratory, technical and engineering personnel.

EXTRUSIONS: Complete department equipped with extruders from 10" to 2" with dies and take-off equipment to make Sheeting, Tubing, Rods, Pipe, Special Cross Sections and Shapes, Thin-gauge Tubing to 60" diam.

HI-IMPACT Modified Styrene Sheet, Tube, Pipe — in translucent and opaque colors, for vacuum-forming, deep drawing, blowing, blanking, printing, boxes, covers, protective shields, ad displays, mannikin forms, toys, radio, television, etc.

DRYCOL: Gering's on-the-spot, perfected dry coloring in-plant colorant for ALL PLASTICS. Standard PMMA, Special, Pearls, Metallics, Housewares Colors, Tinsel Effects.

Of the HIGHEST importance is this: Behind our plant, equipment, production and personnel are 31 Years of learning HOW all the time. To you Technical Men, that factor is paramount. So . . . we CONCENTRATE ON YOU.

GERING

Products • Inc.

KENILWORTH, N. J.

PLASTIC MATERIALS

By Courtesy of Messrs.
Melwood Thermoplastics Ltd.

ADVANCES in EXTRUSION

The most recent installation is the Windsor R.C.100 extrusion machine. It has been installed at the works of Messrs. Melwood Thermoplastics Ltd., of Harpenden, England.

The tubes produced are of 3" diameter with a wall thickness of ¼".

The material used is completely unplasticised P.V.C. Melwood's hope to make 6" and 8" tubes of a special material later in the year. Subsequently tubes of even greater diameter will be made. One of the materials extruded is Tenite II in fluted rod form for screw driver handles.

Write for descriptive literature.

R.H. WINDSOR LTD

LEATHERHEAD ROAD • SOUTH CHESSINGTON • SURREY • ENGLAND

Exclusive U.S.A. Representative:
F. J. Stokes Machine Company,
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2488 Dufferin Street, Toronto

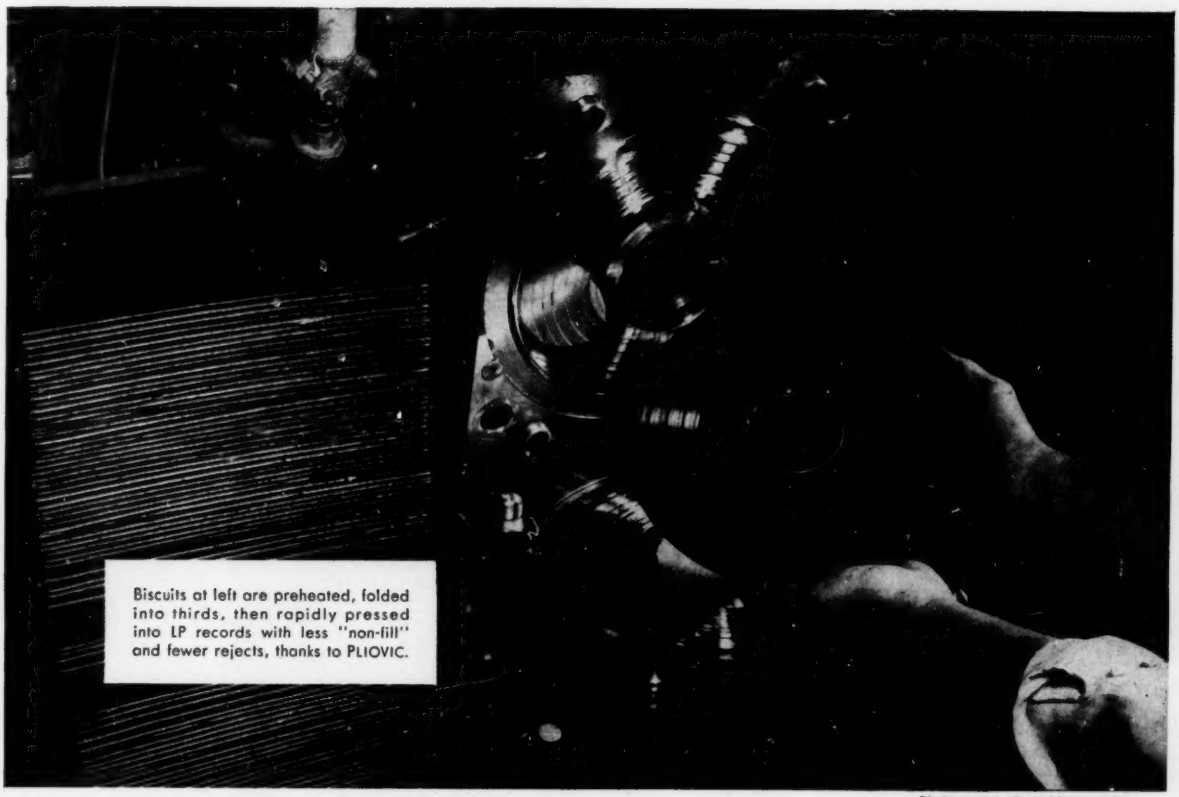


Photo courtesy Capitol Records, Inc.

Record Maker Reports:

FEWER REJECTS with PLIOVIC

SUCCESSFUL production of LP records calls for a relatively soft, free-flowing vinyl compound. Adequate flow is necessary for good mold reproduction in a fast pressing cycle. Too much flow, however, causes trouble through the compound running away during pressing with "non-fill" and too many rejects resulting.

Such was the problem of this famous maker of records. The standard compound flowed too freely – the number of rejects was too high. But the answer was found in PLIOVIC by Goodyear. By modifying the base resin with up to 25% PLIOVIC, the compound was stiffened and the flow decreased to just the rate needed. Net result has been the minimum in rejects from "non-fill."

PLIOVIC may well be the answer to your production problems, too. Best way to find out is to try PLIOVIC with the helpful assistance of your vinyl-wise Chemical Division representative. For full information and samples, write to:

Goodyear, Chemical Division, Akron 16, Ohio

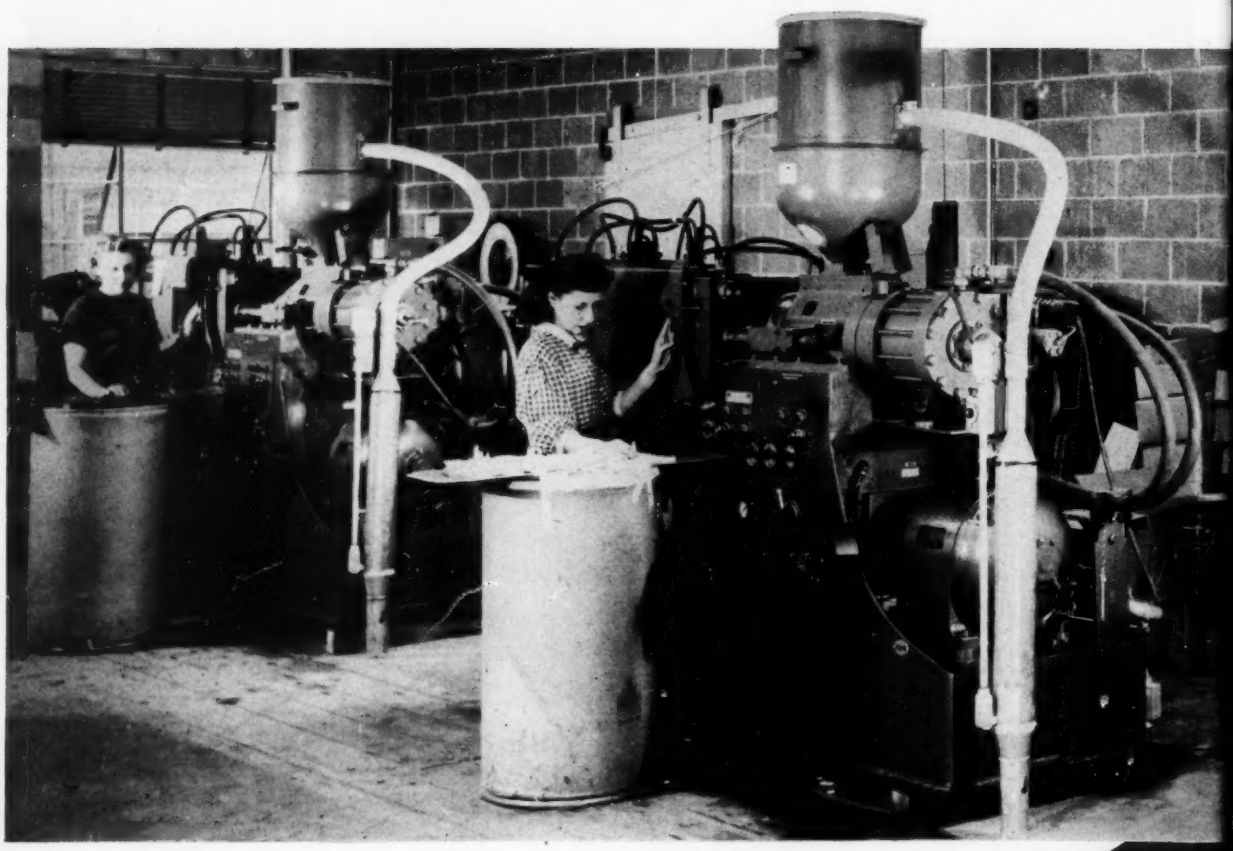
Chemigum, Pliobond, Pliolite, Pliovic–
T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

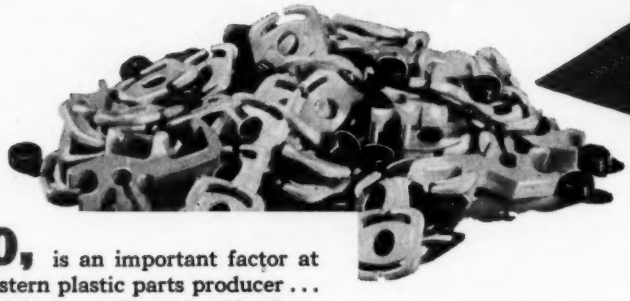
CHEMICAL
GOODYEAR
DIVISION

We think you'll like THE GOODYEAR TELEVISION PLAYHOUSE every other Sunday–NBC TV Network

Use-Proved Products – CHEMIGUM · PLIOBOND · PLIOLITE · PLIOVIC · WING-CHEMICALS – The Finest Chemicals for Industry

"FELLOWS" FOR MOLDING



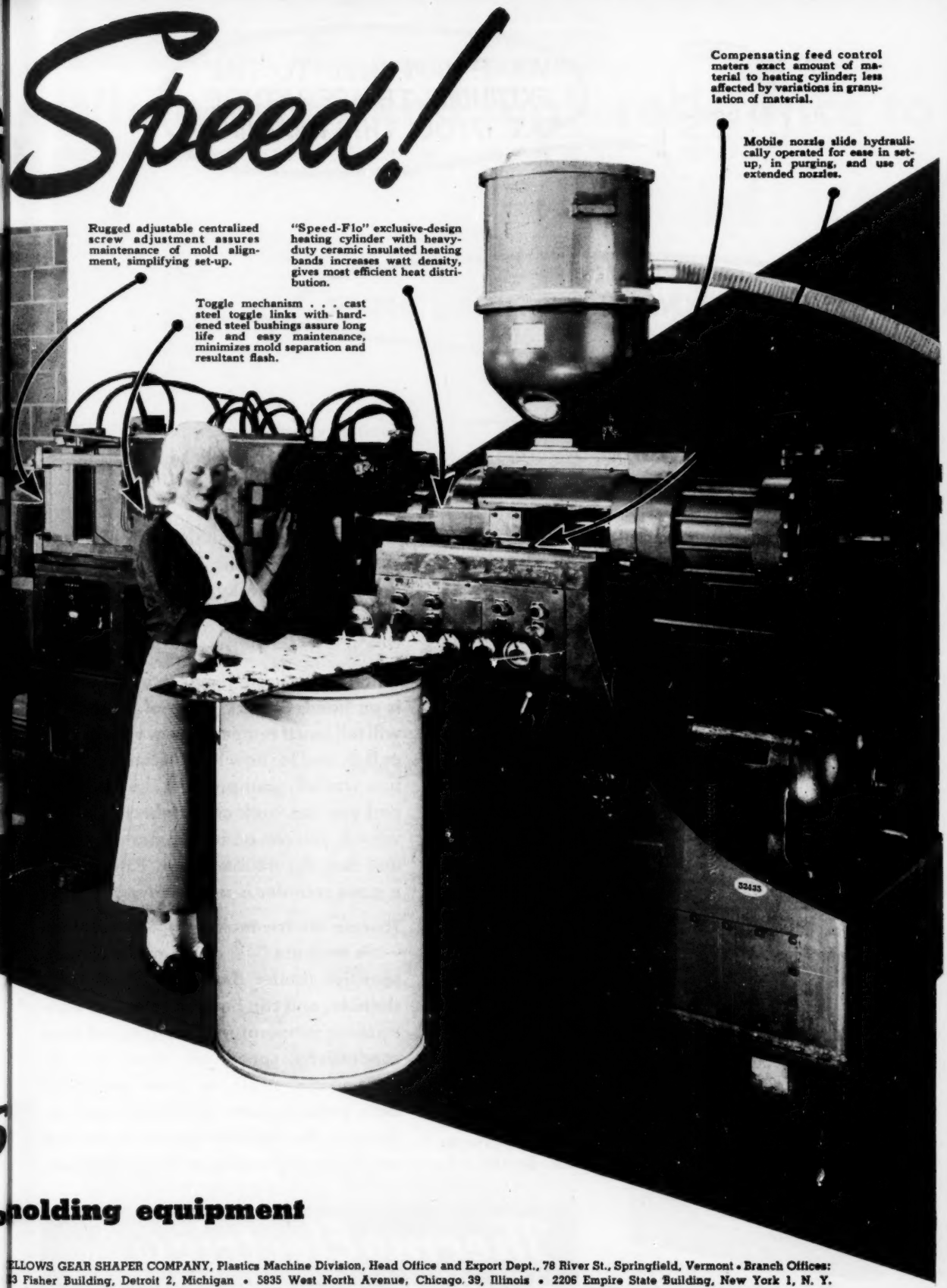


Precision, too, is an important factor at this modern plant of a leading Eastern plastic parts producer . . . 3 of his 8 Fellows *Speed-Flo* Machines are shown in this photo . . . Components for electronics, appliances and fastener fields are molded with unbelievable speed and accuracy . . . and at *low cost.* No wonder 80% of all his injection molding is done on Fellows Machines. Their consistent performance backed up by unmatched Fellows service means money in his pocket, as it would in yours. Write, wire or phone, if you are interested in increasing your molding profits.

Fellows

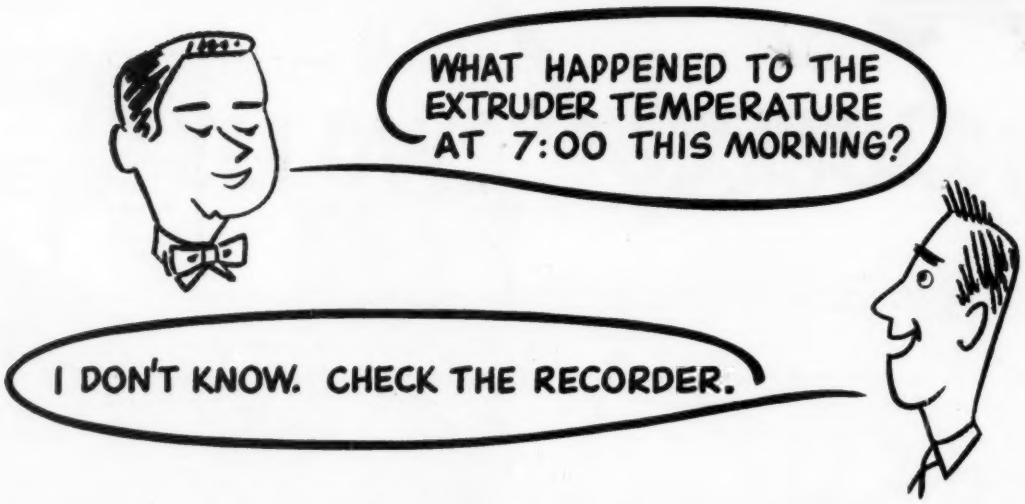
injectio

Speed!



holding equipment

ELLOWS GEAR SHAPER COMPANY, Plastics Machine Division, Head Office and Export Dept., 78 River St., Springfield, Vermont • Branch Offices: 3 Fisher Building, Detroit 2, Michigan • 5835 West North Avenue, Chicago 39, Illinois • 2206 Empire State Building, New York 1, N. Y.



WHAT MAKES A RECORDER GOOD?

Many things. For instance, in the new Thermo Electronic indicating-recorder overall design is simple. The recording system only has three moving parts.

That's one thing. Here's another: the pen arm is driven from a cam. This permits linear charts to be used for almost all measurements, despite the non-linearity of the sensitive element characteristics. When warped or expanded scales are desired, special cams can be supplied.

Furthermore, nylon drive gears are used to provide long life and quiet operation.

There are many other things. If you want to hear about them, let us know. We'll be glad to supply the information. Ask for Catalog No. 60*?*.

AT THE ISA SHOW

This indicating-recorder, along with T-E's other pyrometric equipment, will be at the Instrument Society of America Exhibit, Sherman Hotel, Chicago, Ill., Sept. 21-25, Booth 59.

Even if everything goes the way it should with any process where temperature is involved, sometimes it's important to *prove* everything went right. On the other hand, if something is wrong, if standards aren't met, then it's very important to *know* what went wrong in order to correct it. Was it temperature? Or some other process variable?

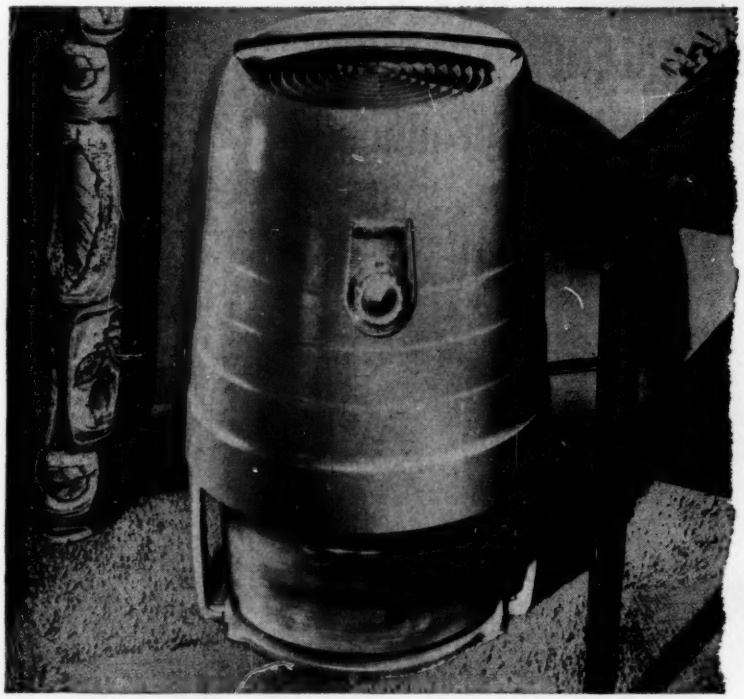
When an accurate temperature recorder is on hand, a quick check of the record will tell you if temperature was too high, or low, and for how long. If the temperature was off, your problem is pinpointed and you can work on it right away. If it wasn't, you can go on to other variables and find the troublemaker. Either way, a good recorder is a time-saver.

Thermo Electric makes a good recorder —it is accurate (±¼ of 1% of the range), sensitive (better than ±1/20 of 1%), durable, and can be used to record variations in temperature, humidity, solution conductivity, speed, pH, direct current, DC voltage, strain, or other variables. Both potentiometer pyrometer and resistance thermometer bridge types are available, depending on the application.

Thermo Electric Co., Inc.
FAIR LAWN NEW JERSEY

Molder: Sinko Manufacturing and Tool Co., Chicago, Ill. *Manufacturer: Admiral Corporation.*

When you need high resistance to moisture, impact, heat, plus good looks



KOPPERS POLYSTYRENES

Type 3	General Purpose Polystyrene
Type 7	Improved Heat Distortion Temperature
Type 8	Highest Heat Distortion Temperature
MC-185	High Impact, Lowest Water Absorption Rate
MC-301	High Impact, Improved Heat Distortion Temperature
MC-305	High Impact, Easy Flow
MC-309	High Impact, Highest Heat Distortion Temperature
MC-401	Medium Impact, Improved Heat Distortion Temperature
MC-405	Medium Impact, Easy Flow
MC-409	Medium Impact, Highest Heat Distortion Temperature

Use Koppers Modified Polystyrene MC-309

A moisture conditioner housing must be good looking because it is exposed to view like any article of furniture. It must remain unaffected in extremely humid atmospheres . . . and it must be tough enough to withstand the ordinary jars and shocks that are met in living room use. Additional utility—in the form of extra heat resistance—must be engineered into this appliance.

Koppers MC-309 Polystyrene fills all these requirements. The housing shown is grained to resemble wood and presents a handsome appearance. Experience has proved that the high resistance of MC-309 to moisture, impact and heat has been completely satisfactory.

For the molder, MC-309 has the additional advantage of easy moldability. The 4 lb. shot necessary to form this housing flowed readily to give a minimum cycle.

Contact Koppers today for information about the polystyrene best suited for your product. Among the wide range of Koppers Regular and Modified Polystyrenes, there is one that will help you to improve product quality or lower your production costs.

Koppers Plastics Make Many Products Better and Many Better Products Possible.

KOPPERS®

Guaranteed by Good Housekeeping

KOPPERS COMPANY, INC., Chemical Division, Dept. MP-93, PITTSBURGH 19, PENNSYLVANIA

SALES OFFICES: NEW YORK · BOSTON · PHILADELPHIA · CHICAGO · DETROIT · LOS ANGELES

From these rolls come
THE MOST ACCURATELY CALENDERED PRODUCTS of rubber and plastics ever produced

Nearly eight years ago Farrel-Birmingham announced the development of its four-roll "Z" calender as *"the most significant advance in calender design since this company first built calenders for the rubber industry in 1854."*

If anyone accepted this statement with reservations at the time, his doubts have long since been dispelled. The remarkable performance of these machines has established new standards for accuracy in calendering both rubber and plastics.

Farrel-Birmingham has made practically all of the "Z" calenders in operation today. Built in a range of sizes up to 36" x 92", these machines are located in plants of major rubber and plastics manufacturers in the United States, Canada, Mexico, and England.

With each installation of the "Z" calender, Farrel-Birmingham engineers have given on-location assistance to assure the most satisfactory performance. The result has been that with this machine a control of production has been obtained, which is more exact than was ever thought possible in the art of calendering.

Farrel-Birmingham's experience with "Z" calenders for numerous applications has been so thorough that, today, calculated risk on the part of the customer is entirely eliminated.

Farrel-Birmingham "Z" calenders are used for calendering both rubber and plastics products. They have proved equally outstanding in the production of film and sheeting and for coating. These machines can be furnished with embossing unit integral with, or separate from, the calender, and with cooling train and windup.

Farrel-Birmingham also manufactures Banbury mixers, extruding machines and mills to complete the equipment assembly of an entire production unit.

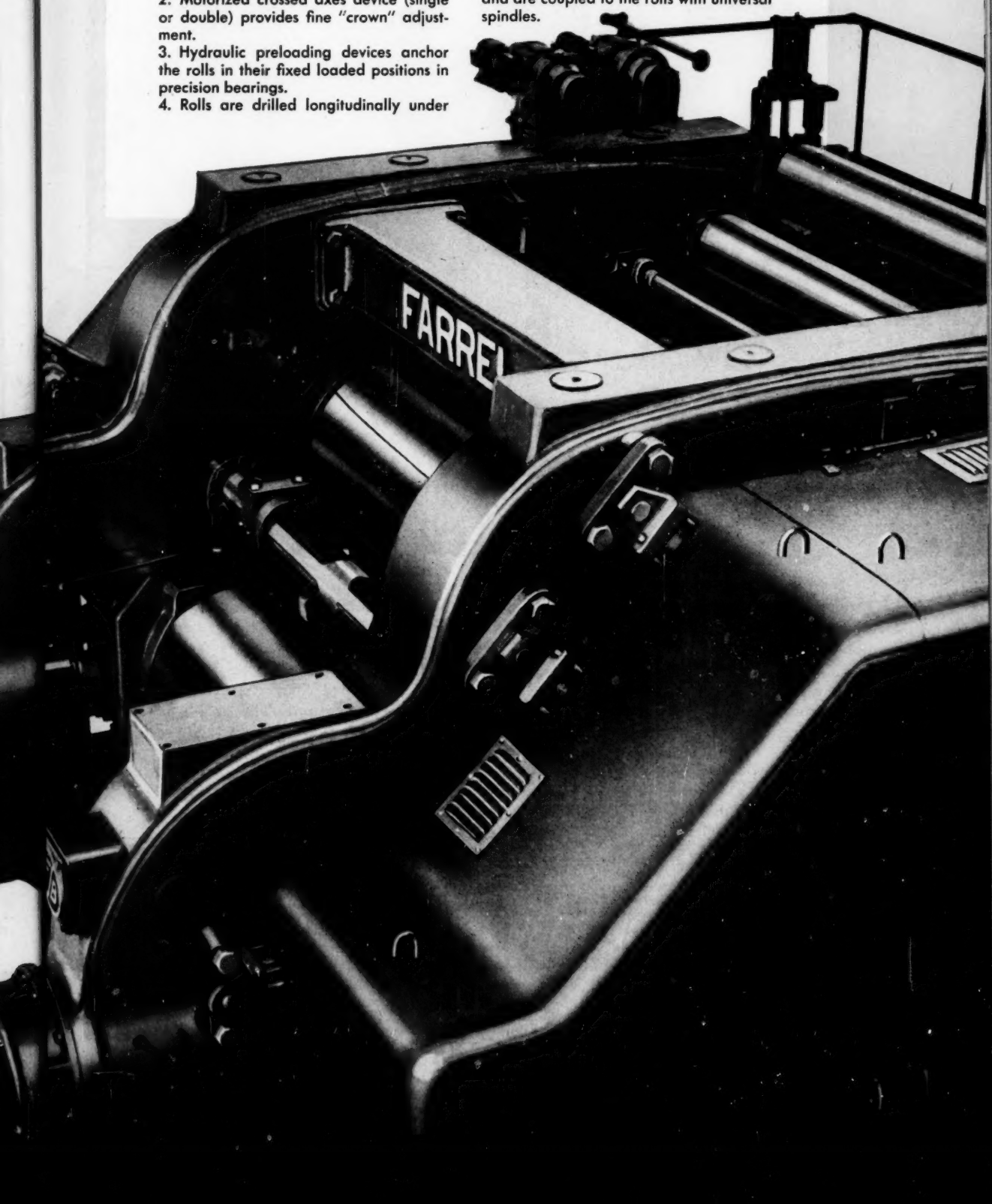
FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT
Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston

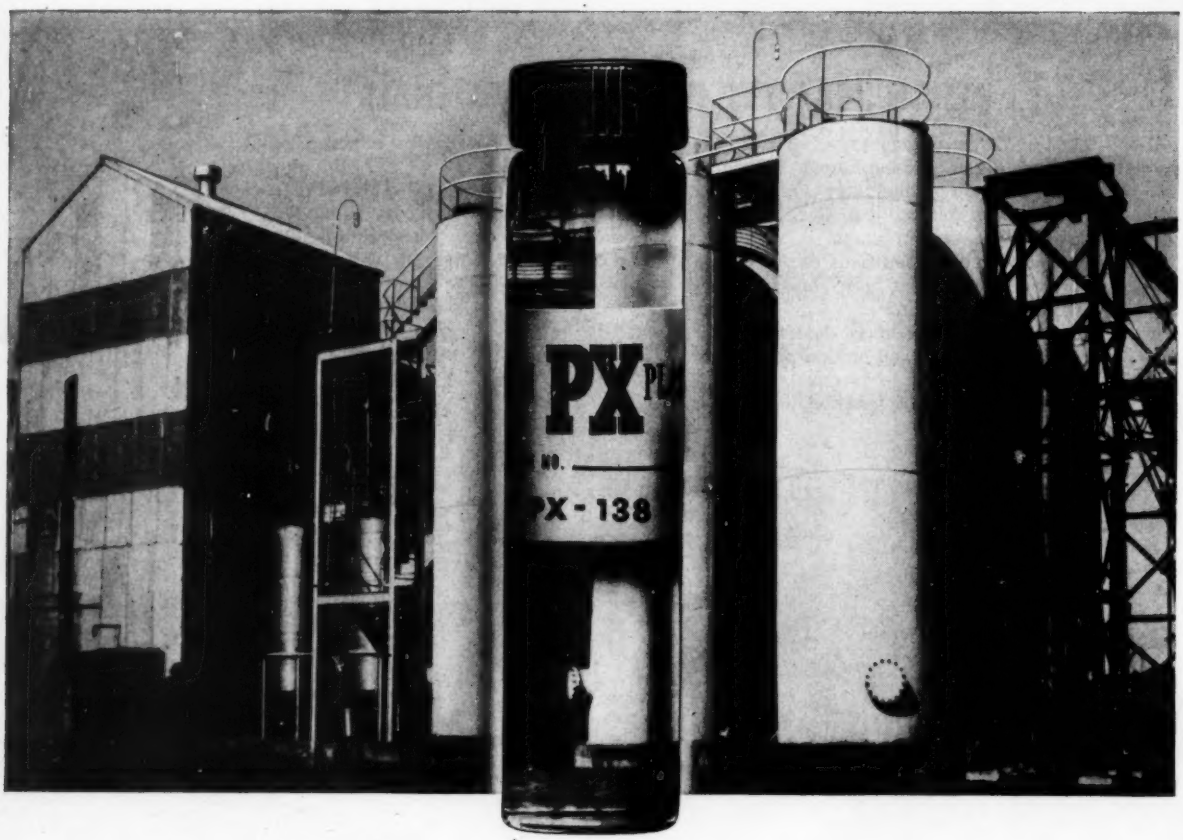
FB-853

Farrel-Birmingham®

DESIGN FEATURES OF THE "Z" CALENDER

1. The "Z" arrangement of the four rolls isolates the separating forces. With only two rolls in any plane, there is no pressure from a third roll to affect roll settings and cause fluctuations in gauge.
2. Motorized crossed axes device (single or double) provides fine "crown" adjustment.
3. Hydraulic preloading devices anchor the rolls in their fixed loaded positions in precision bearings.
4. Rolls are drilled longitudinally under the working surface for most effective temperature control.
5. Uni-drive eliminates drive and connecting gears from the calender itself. The gears are enclosed in a separate housing and are coupled to the rolls with universal spindles.





Behind every WATER-WHITE PITTSBURGH PX PLASTICIZER

—a basic and integrated production plant!

WHEN it comes to turning out *water-white* plasticizers, we think our new Neville Island plant—with its battery of stainless steel reaction vessels and precision control equipment—is second to none. But maintaining this recognized sign of plasticizer purity really goes back to the very moment we begin processing coal at our integrated plant. From our coke ovens, through our basic coal chemical and phthalic anhydride plant, to drumming off, we rigidly control the quality of Pittsburgh PX Plasticizers every step of the way.

The result? A broad and versatile family of water-white plasticizers that deliver peak performance and improved characteristics in your finished products every time. The proof? Send for Pittsburgh PX Plasticizer samples and specifications . . . *today!*

PITTSBURGH PX PLASTICIZERS

PX-104 DiButyl Phthalate
PX-108 DiIsoOctyl Phthalate
PX-109 DiNonyl Phthalate
PX-138 DiOctyl Phthalate
PX-158 DiCapryl Phthalate
PX-208 DiIsoOctyl Adipate
PX-209 DiNonyl Adipate
PX-238 DiOctyl Adipate
PX-404 DiButyl Sebacate
PX-408 DiIsoOctyl Sebacate
PX-438 DiOctyl Sebacate
PX-658 TetraHydroFurfuryl Oleate
PX-917 TriCresyl Phosphate

WAD 4588

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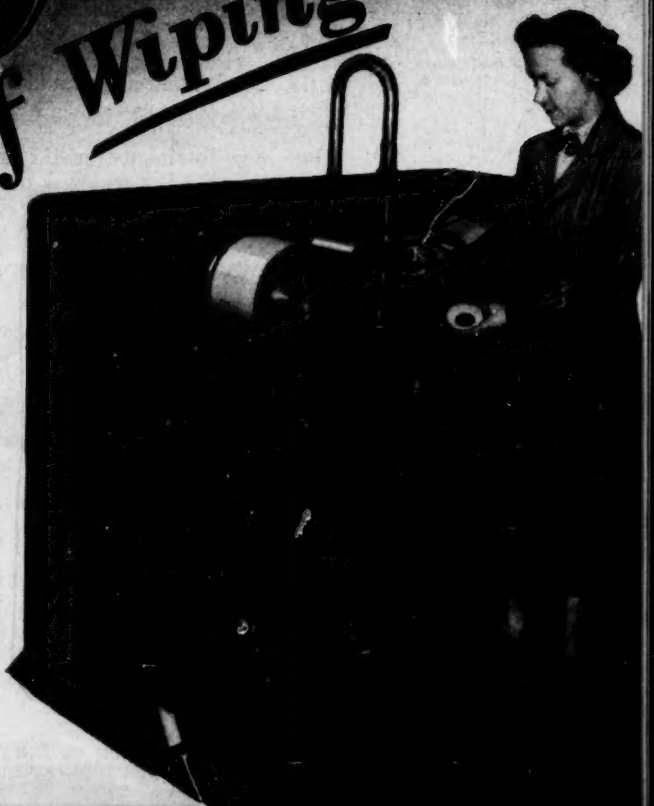
You can cut 65% to 85% off your cost ~ of Wiping Dials

Production records show Automatic Dial Wiper is 3 to 8 times faster than by hand.

The wiping operation is done by a continuous roll towel, which is laundered and re-used over and over. Operator needs no previous experience—just loads, presses foot valve and unloads. *Does a perfect wiping job.*

Make biggest savings on the tough wiping jobs. To set up for a new job, just change mandrels and adjust control knobs. Write or telephone for details . . . **FINISH ENGINEERING CO., INC., 1115 Cherry St., Erie, Pa.** Phones 4-6182 or 5-1690.



FINISH ENGINEERING CO., INC.

Makers of many tools for your decorating needs, including . . . Spray Painting Machines, Automatic and Semi-Automatic. Spray Painting Masks of all types. Adjustable Air Clamping Fixtures. Vacuum Plating Racks. New Brushless Mask Washers.

● Automatic

● Semi-Automatic

● Spray Masks

● Adjustable Fixtures

● Ma... Wash...

Lifting Aviation's Glass Fiber

The increasing speeds attained by jet aircraft, guided missiles, and rockets develop high surface temperatures that are a growing problem to the aviation engineer. Some conventional structural materials lose much of their mechanical strength with continued exposure to such heat.

Among the newer materials developed to lift the "heat barrier" are glass fiber-phenolic plastic laminates bonded with BAKELITE Phenolic Resin BV-11946. They have a high strength-weight ratio. They retain a high percentage of initial strength properties up to 500 deg. F. for periods up to and exceeding 30 minutes. They have low heat-transfer properties, and their coefficient of expansion is lower than that of comparable metal structures. They resist corrosion by sea water, fuels, hydraulic fluids, lubricating oils, and air at high temperatures.

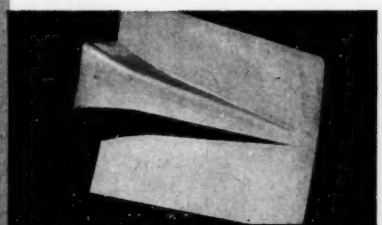
Parts made of these phenolic resin laminates are produced with a minimum of tools, jigs, and fixtures, saving costly floor space. Designing such reinforced plastic structures can also result in man-hour savings in both tooling and production operations.

Moldable at pressures as low as 10-50 psi, glass fiber-phenolic resin laminates can be cured in minutes when matched metal molds are used. Rubber bag or diaphragm molding are also practicable. They can be handled in dry form and laid up in a mold in much less time than the conventional wet lay-up system requires.

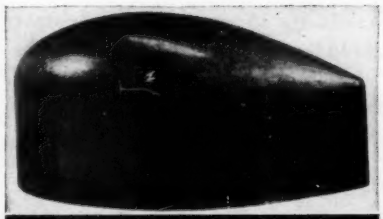
For more information on the use of glass fiber laminates made with BAKELITE Phenolic Resin BV-11946, write Dept. RC-13, presenting your requirements. Bakelite Company engineers are available to assist in evaluating and working out your plans.

"Heat Barrier"... Phenolic Plastic Laminates

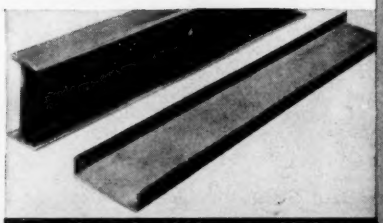
Exhaust duct made by using break-away plaster mold



Air-intake for aircraft, made with a matched metal mold



Fairing made on male mold, rubber bag method, vacuum pressure



Channel and I-beam molded by rubber bag method

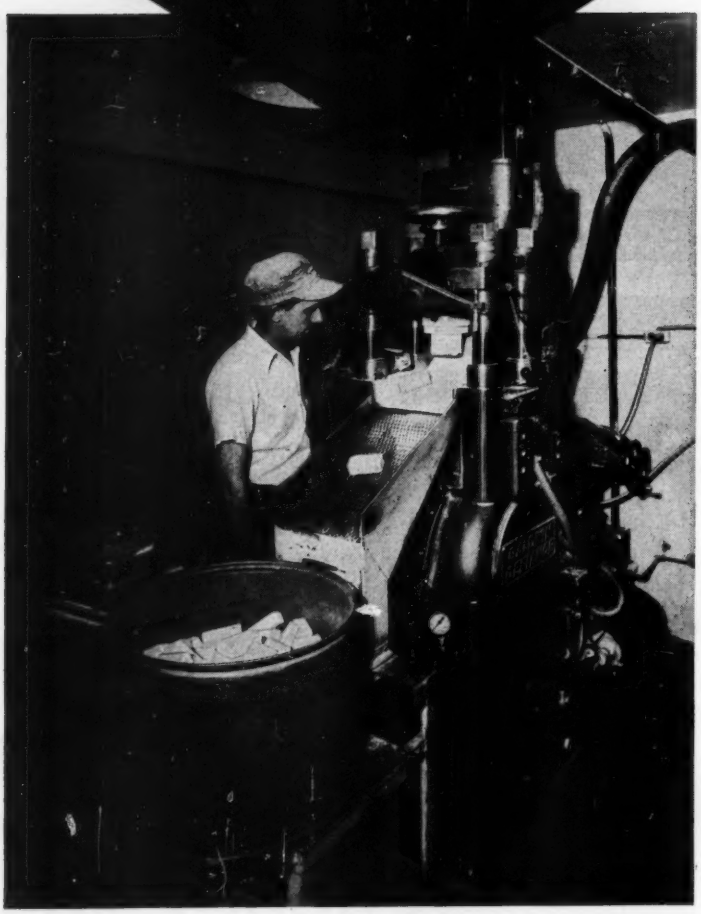
Hot air duct, formed by wrapping impregnated glass cloth over split mandrel, covering with cellophane, and curing for one hour at 300 deg. F.

Photographs courtesy of Zenith Plastics Company, Gardena, Cal. and Bassons Industries, Bronx, New York.

BAKELITE
TRADE-MARK
PHENOLIC RESINS
TRADE MARK
BAKELITE COMPANY
A Division of
Union Carbide and Carbon Corporation
UCC
30 East 42nd Street, New York 17, N. Y.
In Canada:
Bakelite Company (Canada) Ltd., Belleville, Ont.

Plant Manager Ed Campi Reports:

"... best preform press on the market for high production of large pills."



THE INTERNATIONAL MOLDED PLASTICS PROBLEM:

To maintain the high quality of their dinnerware, International Molded Plastics, Inc., depends upon obtaining very accurate weight, density and dimensions in preforming melamine formaldehyde.

THE BALDWIN SOLUTION:

Edward Campi, Plant Manager of International Molded Plastics, Inc., Cleveland, explains how three Baldwin Model #20 Preform Presses have solved their threefold problem:

1. **"Inaccurate weight pills are costly because flash and rejects are a total loss. By holding preform weight as accurate as possible with production speeds that are necessary, our Baldwin press has reduced rejects greatly.**

2. **"Melamine formaldehyde requires eight to ten tons p.s.i. to give preforms of satisfactory hardness. Only the Baldwin-Deflance press meets these specifications to our satisfaction.**

3. **"We can prewarm electronically several preforms uniformly at one time because the Baldwin-Deflance machine makes preforms of uniform thickness."**

Mr. Campi reports a further benefit: "Not only can we make a die change in fifteen to twenty minutes, but also the Baldwin press is constructed without exposed gears or other working parts which would make it difficult to clean . . . a major problem in manufacturing pastel and dark shades of dinnerware."

WHAT'S YOUR PRESSING PROBLEM?

For help in solving any of your compacting problems, write for Bulletin 323 to Dept. 4326, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pa.

BALDWIN BLH LIMA-HAMILTON

BALDWIN-LIMA-HAMILTON

General Offices: Philadelphia 42, Pa. • Offices in Principal Cities

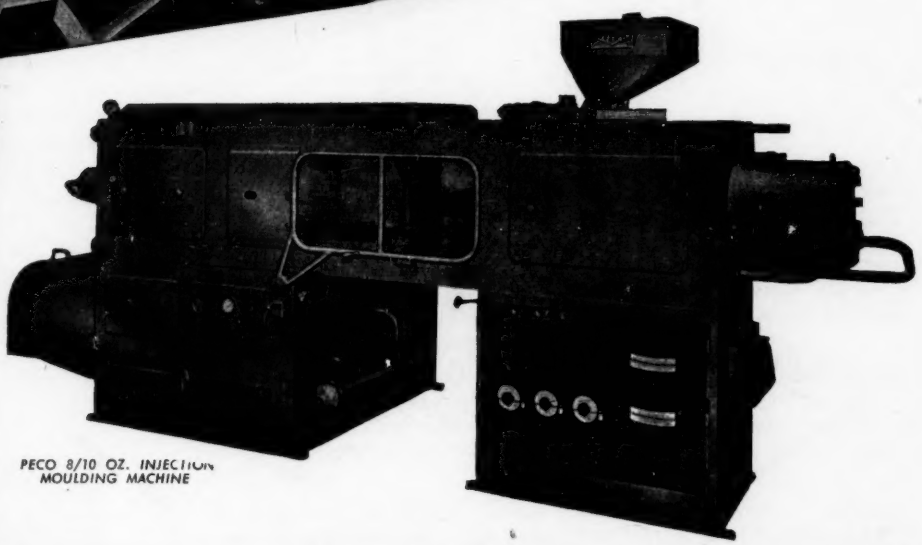
facts that speak for themselves

12,000
SHOTS *per* WEEK

Re-impression moulding in polythene, of automobile number plate digits and letters. Mould designed and mouldings produced by the Ventmore Manufacturing Co. Ltd in conjunction with Hills (Patents) Ltd. under Patents Nos. 661276 and 661354.

This record of weekly production can be taken as typical of the first-class performance of PECO MOULDING MACHINES. Their output can be relied on—and it is a maximum output for any type of production.

In the 8 oz. and 16 oz. machines, important new developments have been introduced, giving increased shot capacity and enabling these models to be uprated to, respectively, 8/10 oz. and 16/24 oz. machines. Further details of the full range, including smaller capacity machines, will be gladly sent on request.



PECO 8/10 OZ. INJECTION MOULDING MACHINE

MOULDS

PECO MOULDS. Expert designers and mould makers are employed and moulds can be supplied to samples submitted, including die-sinking models if required. An important side of the Company's work is the hobbing of cavities for moulds and medallions—the plant includes a 3,000-ton hobbing plant. Master hobs to customers' samples made as required.

PECO PRODUCTS

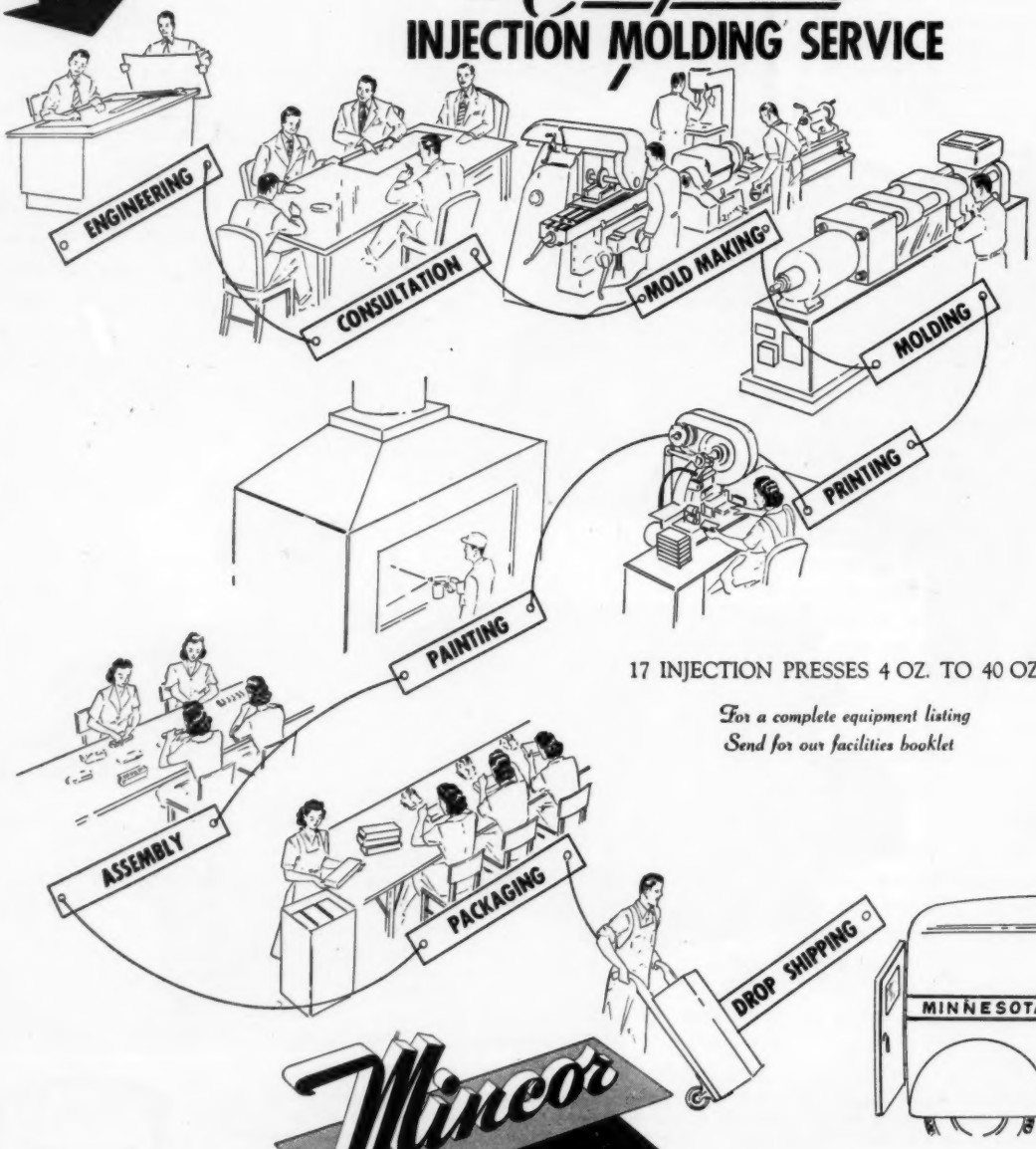
THE PROJECTILE & ENGINEERING COMPANY LTD.

ACRE STREET, BATTERSEA, LONDON, S. W. 8, ENGLAND

Telephone: Macaulay 1212. Telegrams: "Projectile, Clapham, London." Cables: Projectile, London.

YOUR PLASTICS DEPARTMENT IS READY TO SERVE YOU

A *Complete* INJECTION MOLDING SERVICE



17 INJECTION PRESSES 4 OZ. TO 40 OZ.

For a complete equipment listing
Send for our facilities booklet

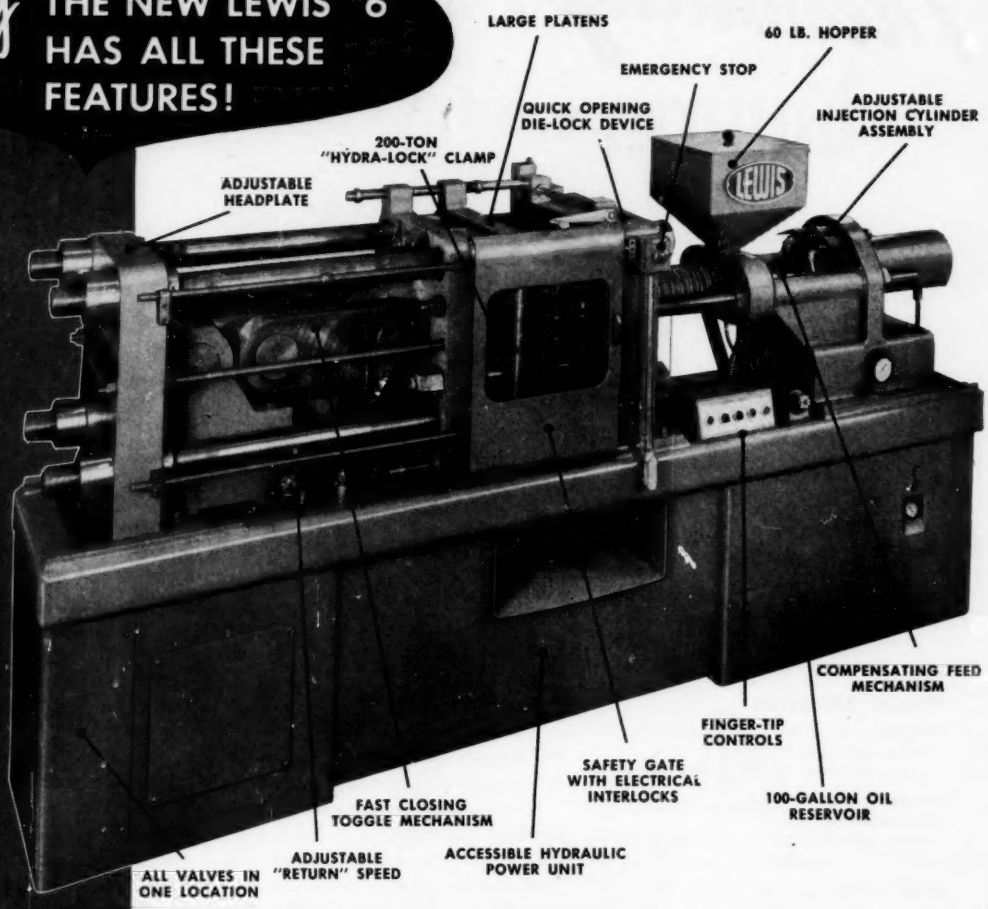
Minco

MINNESOTA PLASTICS CORPORATION

INJECTION MOLDERS OF THERMOPLASTICS

GARFIELD 5368 • 366 WACOUTA ST., ST. PAUL 1, MINNESOTA • NESTOR 3144

Only THE NEW LEWIS "6" HAS ALL THESE FEATURES!



- SPEED
- SIMPLICITY
- SAFETY
- STRENGTH

FOR LOW COST INJECTION MOLDING

The LEWIS "6" permits molding of large projected area parts formerly impossible on machines of comparable size. (Shots of 6.8 oz. of polystyrene have been molded repeatedly at rate of 2½ per minute.) Its fast automatic molding cycle, new "HYDRA-LOCK" clamping mechanism, durable construction and versatility permit this machine to do the work of considerably larger units at a fraction of their initial and normal operating costs.

Only tenths of a second and a cupful of oil are required to develop a 200-ton clamping pressure in the exclusive new LEWIS "HYDRA-LOCK". The safest, most powerful clamping device available today, "HYDRA-LOCK" also facilitates quicker, easier mold setting procedures.

All features of the LEWIS "6" are standard equipment . . . included in one remarkably low price. FOR PRECISION MOLDINGS AND MORE PROFITABLE OPERATION . . . SPECIFY THE LEWIS "6".

WRITE FOR NEW 8-PAGE BULLETIN 102 FOR COMPLETE DATA

another FIRST by

LEWIS

THE LEWIS WELDING & ENGINEERING CORPORATION

1869-LW

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Presenting

NOW . . . get PERMANENT FIRE RESISTANCE WITH NO LOSS IN HEAT RESISTANCE

TYPICAL PROPERTIES

- Weight loss of castings:
  After 168 hrs. at 392°F 2-3%
  After 720 hrs. at 392°F ... 13-15%
- Flexural strength retention of glass cloth laminates:
  After 168 hrs. at 392°F .. up to 90%
  After 720 hrs. water immersion 92%
- Shrinkage during curing 5%
- ASTM heat distortion point of castings ..... 212-220°F
- Electrical properties of castings at 10^9 cycles:
  Dielectric constant 2.85
  Power factor ..... .00575
  Loss factor ..... .0164

FOR COMPLETE INFORMATION on HETRON resins, send today for Bulletin No. 50. It fully treats properties of the liquid resins, cured unfilled resins, and glass cloth laminates. Includes general handling and curing recommendations, and other useful information.

In HETRON, a new family of self-extinguishing resins, you will find *in full measure* all the properties a good fire-resistant polyester should have.

Heat resistance, in particular, is outstanding. Castings aged at 200°C lost only 2% of weight in seven days (as compared with 10% or more for standard non-fire-resistant resins, and up to 20% for ordinary fire-resistant resins).

Glass cloth laminates aged at 200°C for seven days retained up to 90% of their room temperature flexural strength. Fire resistance was virtually unchanged in the same period.

HETRON resins are self-extinguishing even without the use of additives, because they contain 30% chemically-bound chlorine. At the same time, they are clear and stable. Where even higher fire resistance is desired, addition of 5% antimony trioxide results in laminates that will not support a flame for one second, even after five repeated applications of a Bunsen flame.

Transmission of water vapor through HETRON resins is very low, compared to standard resins—so low that it is difficult to measure accurately. Absorption of water is also lower. For these reasons, electrical properties of the resins are much less affected by long exposure to high humidities and elevated temperatures than ordinary polyesters.

Shrinkage-on-cure of less than 5% by volume, and little or no air inhibition, are important advantages of the new resins. Resistance to acids is better than that of standard resins. Heat distortion temperatures are better than with many standard polyesters.

HETRON resins are light-colored, transparent viscous liquids. At present, they are available in drum quantities.

The facilities of our laboratories are available to cooperate with you in the application of HETRON polyester resins.

From the Salt of the Earth

HOOKER ELECTROCHEMICAL COMPANY

18-47TH STREET, NIAGARA FALLS, NEW YORK

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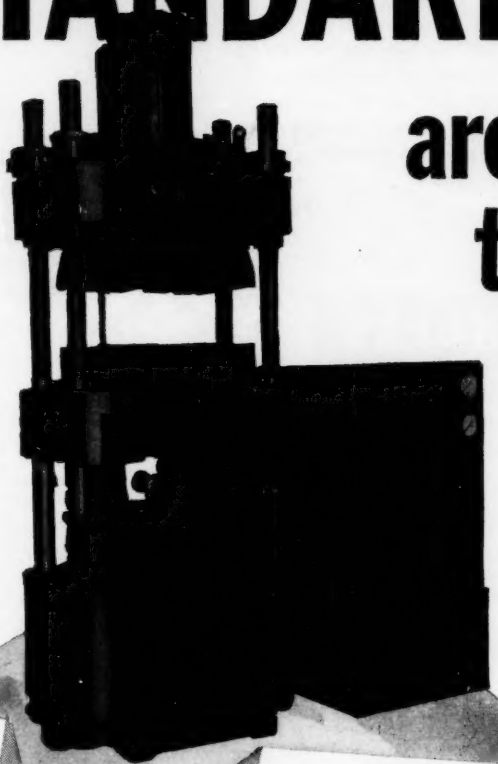
HOOKER CHEMICALS

9-1307

it's STANDARD around the World



TOP PERFORMANCE—LOW COST

IDEAL MOLDING ACTION CREATES MORE UNIFORM PRODUCT

HIGH PRESSURE—LOW POWER CONSUMPTION

PERFECTLY CONTROLLED PRESSURE

PERFECTED TOGGLE CONSTRUCTION

COMPACT UNIT MEANS SIMPLE INSTALLATION

—EXCELLENT REASONS WHY STANDARD MOLDING PRESSES HAVE BEEN IN GROWING DEMAND AROUND THE WORLD SINCE 1936

STANDARD MOLDING PRESSES

both compression and transfer models, are semi-automatic, hydraulically operated toggle presses in 50 to 300 ton capacities. Their ideal molding action results in reduced mold wear, permits compression molding of many parts containing inserts, and provides a more uniform product. ***STANDARD MOLDING PRESSES*** *are money-savers and time-savers, with mechanical features which assure IMPROVED QUALITY, INCREASED OUTPUT, LOWERED COST.*

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DAVIS-STANDARD SALES CORPORATION

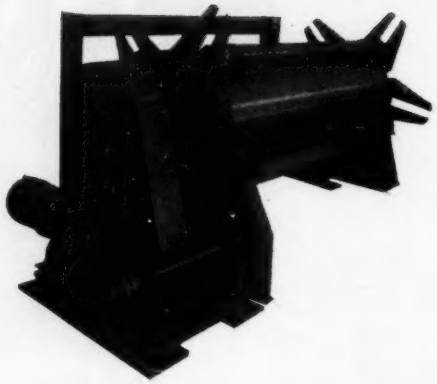
16 Water Street, Mystic, Connecticut

Selling Agents for

THE STANDARD MACHINERY COMPANY

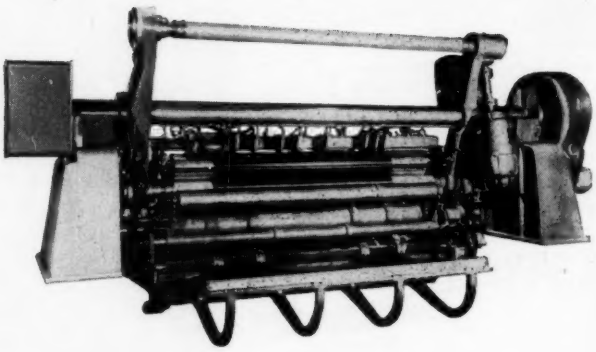
Extruding Machines and Molding Presses

"Ferristart" Surface Winder for film and sheeting with manual continuous starts on new cores. Convenient to operate, convenient to remove finished rolls for packaging. Applicable at speeds up to 75 yards per minute.



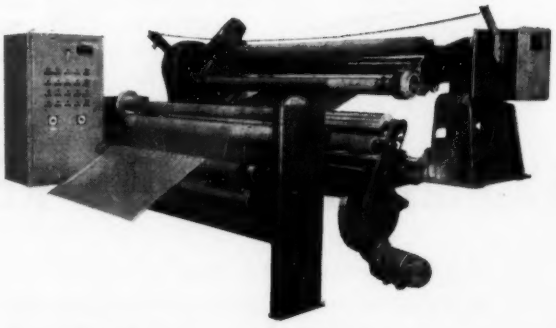
PLASTIC WINDERS

Continuous surface or center winder for film and sheeting for a wide range of gages, tensions, speeds, widths and roll diameters.



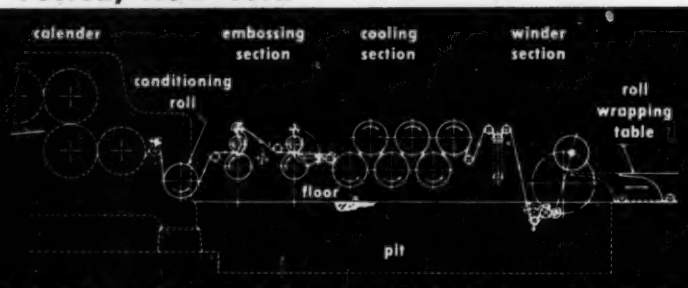
Fully automatic Model 40-S center wind for sheeting Square even starts without adhesive on the core. Full tension control Slit webs can be wound side by side.

Fully automatic Model 40-F center wind for film at speeds up to 150 yards per minute. Even starts without fold back. Full tension control thru a range of 6# total minimum to 45# maximum on full width web.



THE BLACK-CLAWSON COMPANY
DILTS MACHINE WORKS DIVISION
Fulton, New York

Dilts



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Embossers
Winders
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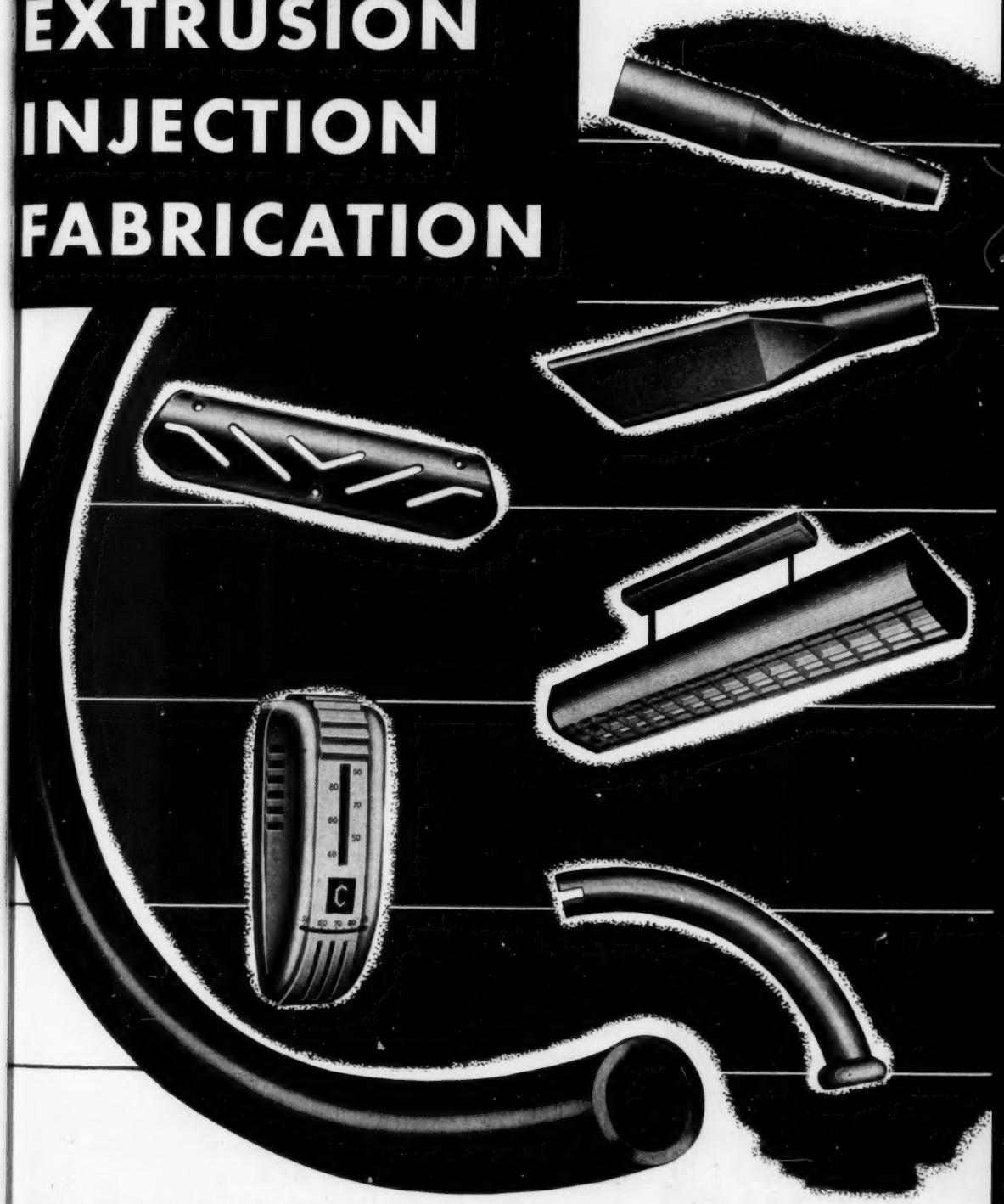
EXTRUSION
INJECTION
FABRICATION



Send us your problem. There's an experienced Yardley representative near you.

YARDLEY PLASTICS CO.

142 PARSONS AVE., COLUMBUS, OHIO

IN CANADA: **DAYMOND CO., LTD.**, CHATHAM, ONTARIO

CARBIDE'S

Coal-Hydrogenation CHEMICALS

- First commercial continuous-process plant producing chemicals directly from coal.
- Plant makes phenols, anilines, aromatic hydrocarbons, heterocyclic amines.
- Over 100 chemicals identified in product streams.
- Now available commercially—mixtures of reactive, *meta*-substituted monohydric phenols ***in tank-car quantities:***

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Carbide and Carbon Chemicals Company
A Division of
Union Carbide and Carbon Corporation
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META-PHENOLS 220

Boiling range 207-230°C. A mixture of cresols, xylenols, and ethyl phenols—2.2 *ortho* and *para* positions per molecule are open. Phenol and 2,6-xylenol are absent. Phenolic content—about 98%.

HIGH BOILING PHENOLS

Boiling range 230-270°C. A mixture of short-chain alkyl-substituted phenols—2.5 of three reactive *ortho* and *para* positions are open. Phenol and cresols are absent. Contains about 30% indanols-4 and -5. Phenolic content—about 98%.

Call or Write the nearest Carbide and Carbon office for samples and prices. In Canada: Carbide and Carbon Chemicals Limited, Toronto.

Ask for the technical bulletins on Meta-Phenols 220 (Form 8107), and High Boiling Phenols (Form 8103).

More coal-hydrogenation chemicals will be available soon—watch for them.

Maintains "new pump" clearances for years with adjustable TIMKEN® bearings

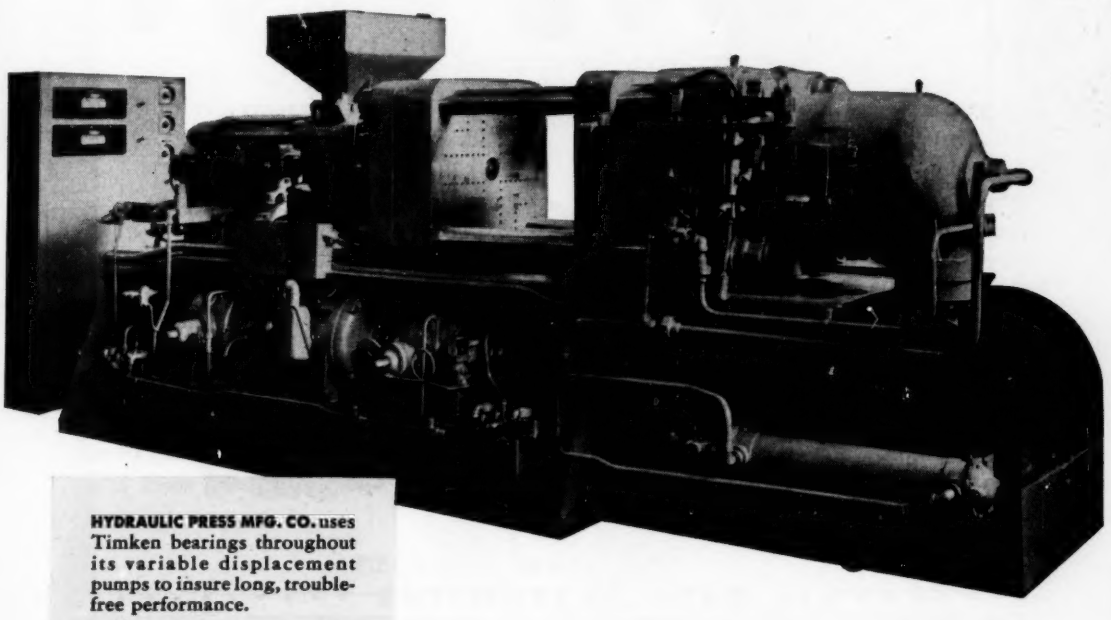
THE "heart" of this H-P-M plastics injection molding machine is the variable displacement pump that powers both the injection unit and the hydraulic mold clamp. Built to precision standards, the pump will maintain "new pump" clearances for years because Hydraulic Press Mfg. Co. engineers specified Timken® tapered roller bearings throughout the pump.

Because of their tapered construction, Timken bearings take radial and thrust loads in any combination. This, plus precision manufacture, permits Timken bearings to maintain an extremely close clearance between pintle and rotor.

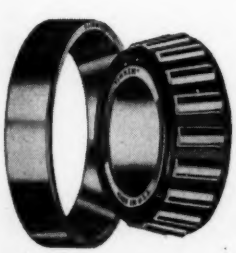
Timken tapered roller bearings normally last the life of the pump because they're engineered for the job and made of special analysis Timken fine alloy steel.

You get these same benefits in the machinery you build or buy when you specify Timken bearings. Make sure the trade-mark "Timken" is stamped on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



HYDRAULIC PRESS MFG. CO. uses Timken bearings throughout its variable displacement pumps to insure long, trouble-free performance.



TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

DESIGN LEADERSHIP

The first Timken tapered roller bearing was produced in 1898. Since then the one-piece multiple perforated cage, wide area contact between roller ends and ribs, and every other important tapered roller bearing improvement have been introduced by The Timken Roller Bearing Company.

The Timken Company leads in: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. special analysis steels.

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◎ AND THRUST → ◎ ← LOADS OR ANY COMBINATION →◎←

TAILORED TO YOUR O

THREE VERSATILE, FA

Firestone EXON 905, 915, 925

Are you hobbled by the restrictions of operating temperature? Cut off from production-speeding, product-improving advantages by the limitations of your processing equipment? If so, then the development of Firestone EXON Resins 905, 915 and 925 will mean a great deal to you.

For here, at last, are three new polyvinyl chloride resins that offer you:

- **Shorter fusing time** . . . for a faster, more economical operation!
- **Freedom from "fisheyes"** . . . assuring a higher quality, more uniform product!
- **Extremely rapid blending** . . . either hot or cold.

PLUS

the right resin for *your* operating temperature!

Between them, EXON 905, 915 and 925 cover a processing temperature range from 275° F. to 375° F. All you need do is select the correct EXON resin for your equipment . . . and you are automatically assured of an easier, faster operation and a finer final product.

PHYSICAL PROPERTIES

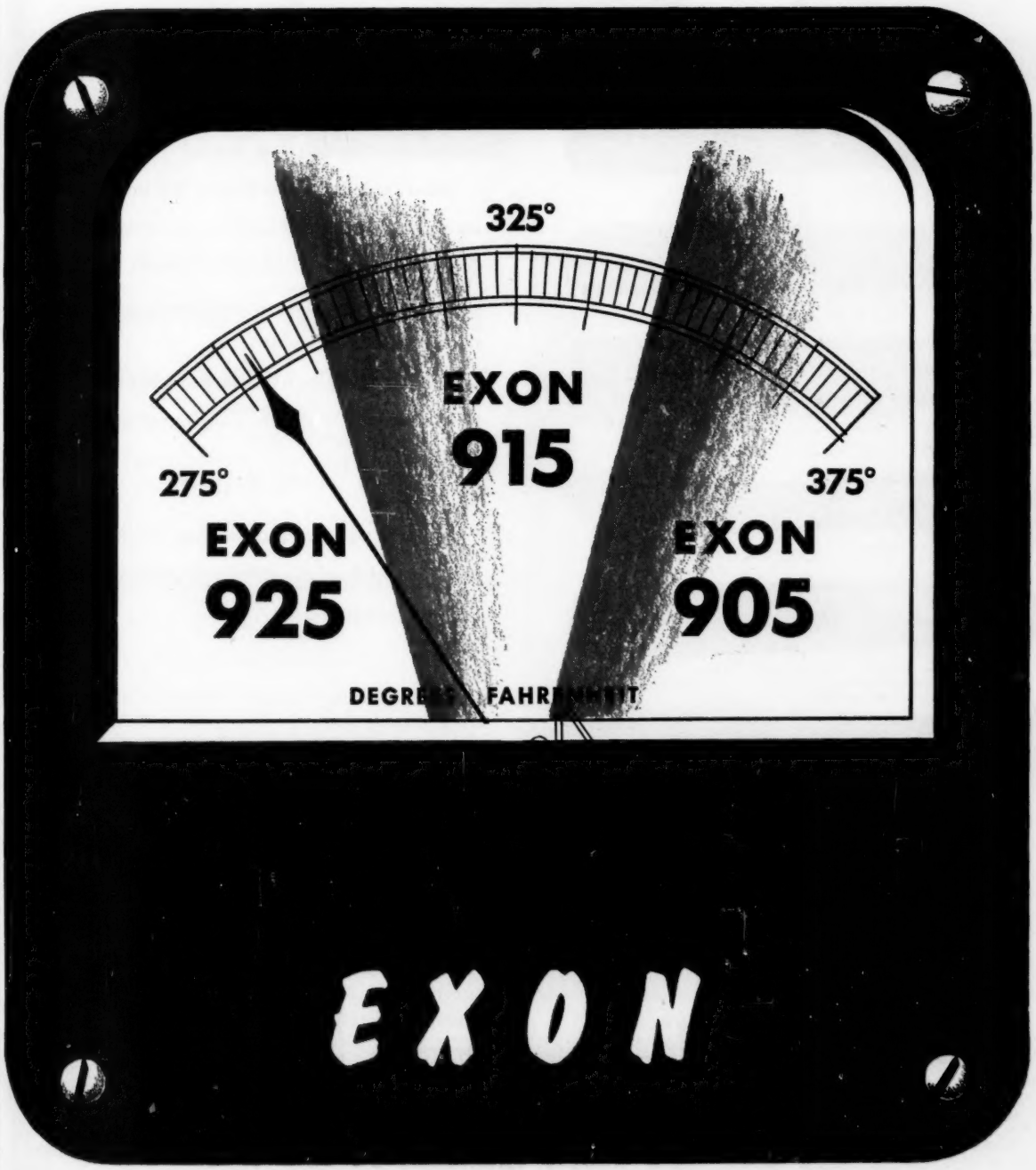
	FORM	SPECIFIC GRAVITY	AVERAGE RELATIVE VISCOSITY	AVERAGE BULKING DENSITY (gm/cc)
EXON 905	White Powder	1.40	2.50	0.45
EXON 915	White Powder	1.40	2.30	0.45
EXON 925	White Powder	1.40	2.05	0.45

For further information on Firestone's complete line of high quality EXON resins . . . or for the free assistance of Firestone's technical service, call or write:

CHEMICAL SALES DIVISION
FIRESTONE PLASTICS COMPANY · POTTSTOWN, PA., DEPT. 16B
Division of Firestone Tire and Rubber Co.

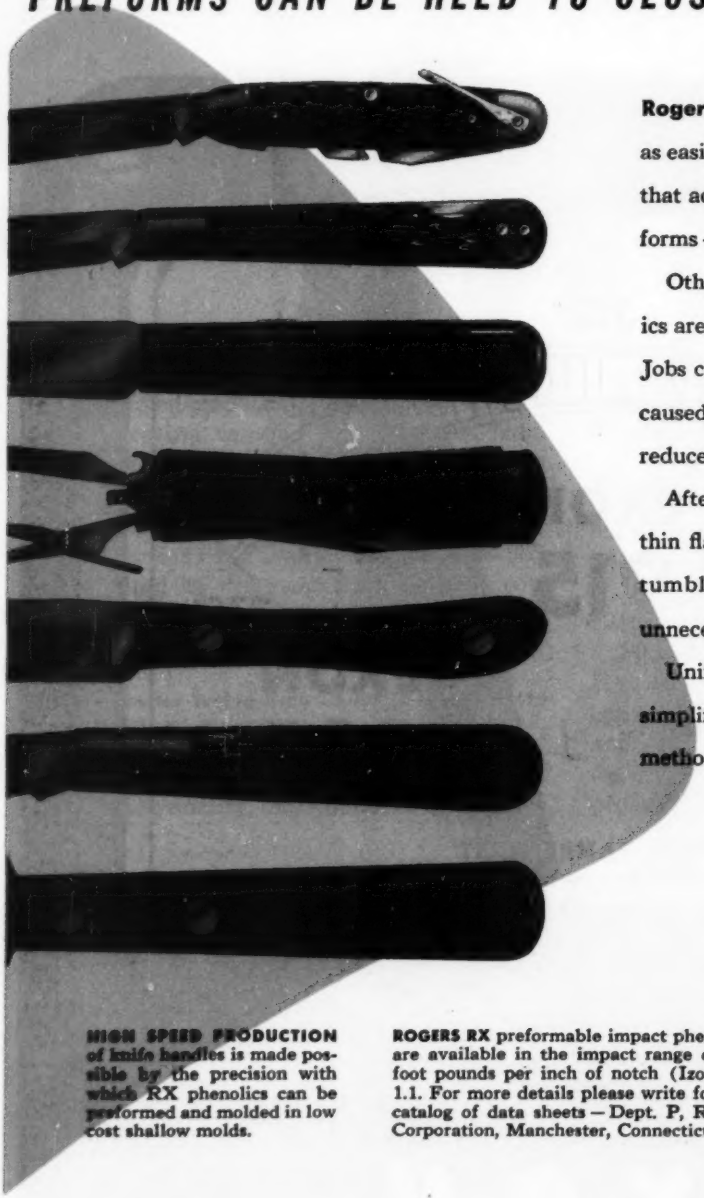
R OPERATING TEMPERATURE!

E, FAST-FUSING NEW VINYL RESINS



Why ROGERS CORPORATION Impact Phenolics SPEED MOLDING OPERATIONS

PREFORMS CAN BE HELD TO CLOSE WEIGHT TOLERANCES



Rogers RX impact phenolics can be handled almost as easily as general purpose materials. One reason is that accurate weight tolerances can be held on preforms – as close as 1% if desired.

Other reasons are that Rogers RX impact phenolics are fast curing and low in bulk factor (3.5 to 1). Jobs can be run on high speed presses. And rejects caused by overloading or underloading are sharply reduced if not eliminated.

After molding, parts of Rogers phenolics have a thin flash, which can be easily removed – often by tumbling. Costly hand finishing operations are unnecessary.

Uniform pellet size of Rogers impact phenolics simplifies and speeds volumetric loading when this method is required.

HIGH SPEED PRODUCTION of knife handles is made possible by the precision with which RX phenolics can be preformed and molded in low cost shallow molds.

ROGERS RX preformable impact phenolics are available in the impact range of .05 foot pounds per inch of notch (Izod) to 1.1. For more details please write for our catalog of data sheets – Dept. P, Rogers Corporation, Manchester, Connecticut.

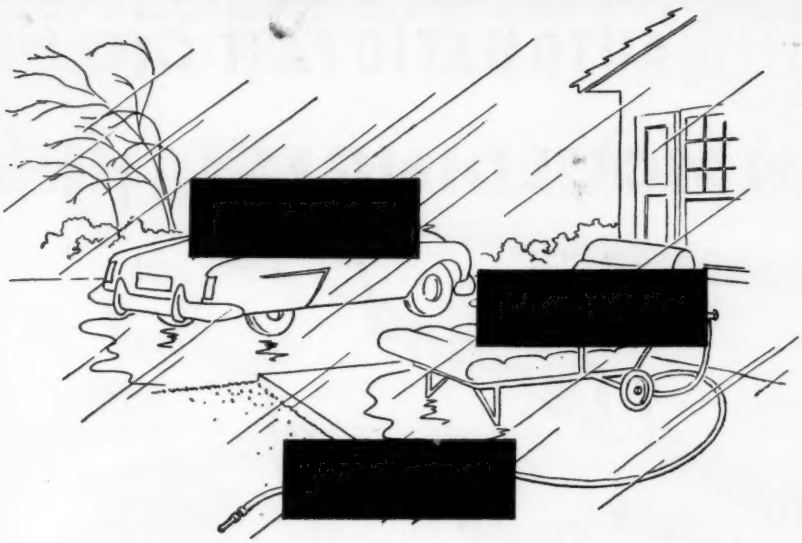
Better Parts for Better Products

ROGERS
CORPORATION
Established in 1832

YOU NAME IT — WE'LL MAKE IT — AND FABRICATE IT, TOO

DUROIDS	ELECTRICAL INSULATION	PLASTICS	SHOE MATERIALS
for Gaskets, Filters, Electronics . . .	for Motors, Transformers, Generators . . .	Molding Compounds and Laminates	for Counters, Midsoles, Liners

YOU SAVE WHEN ROGERS FABRICATES FINISHED PARTS



If exposure shortens the life of your vinyl products

. . . stabilize with "Dutch Boy" Dyphos

You can't do much about the weather.

But stabilize your vinyl products with "Dutch Boy" Dyphos, and you'll see that weather can't do much harm to them.

With Dyphos, you'll find that under outdoor exposure your opaque vinyls have excellent color retention and long-lasting flexibility. That's because Dyphos imparts unequaled light stability.

In processing, too, the use of "Dutch Boy" Dyphos works to your advantage because of its excellent heat stability.

So, whether you work with plastisols or organosols . . . whether your method is slush or conventional molding, extruding, calendering, or coating . . . use "Dutch Boy" Dyphos.

For more information on Dyphos (or any of the other "Dutch Boy" stabilizers) just write. We will be glad to supply factual data and technical assistance.

"Dutch Boy" Stabilizers

PRODUCT	USE
TRIBASE (Tribasic Lead Sulphate)	Electrical and other compounds requiring high heat-stability
TRIBASE E (Basic Lead Silicate Sulphate Complex)	Low volume cost insulation
DS-207 (Dibasic Lead Stearate)	Stabilizer-lubricant for sheeting, film, extrusion and molded compounds
PLUMB-O-SIL A (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored sheeting and upholstery stocks
PLUMB-O-SIL B (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored film, sheeting, belting
PLUMB-O-SIL C (Co-precipitate of Lead Orthosilicate and Silica Gel)	Highly translucent film and sheeting
DYTHAL (Di-basic Lead Phthalate)	General purpose stabilizer for heat and light. Good electrical properties
	Outstanding for heat and light in all opaque stocks, including plastisols and organosols
NORMASAL (Normal Lead Salicylate)	As stabilizer or co-stabilizer in vinyl flooring and other compounds requiring good light-stability
BARINAC (Barium Ricinoleate)	Stabilizer-lubricant for clears

Dutch Boy®

*Reg. U. S. Pat. Off. **CHEMICALS** *

NATIONAL LEAD COMPANY

111 Broadway • New York 6, N. Y.

In Canada: **CANADIAN TITANIUM PIGMENTS LIMITED**

630 Dorchester Street, West • Montreal

THE DOWDING AUTOMATIC *FAST-CYCLING*

INJECTION MOULDING MACHINE

Phenomenal Demand— Extends Manufacturing Programme!

- 1,200 CYCLES PER HOUR
- FULLY AUTOMATIC AND FOOLPROOF
- FAST PLASTICIZING AT UNUSUALLY LOW INJECTION PRESSURE
- AUTOMATIC LUBRICATION
- 3-ZONE CYLINDER HEATING
- VICKERS-DETROIT HYDRAULIC EQUIPMENT

BRITISH MADE

EARLY DELIVERY

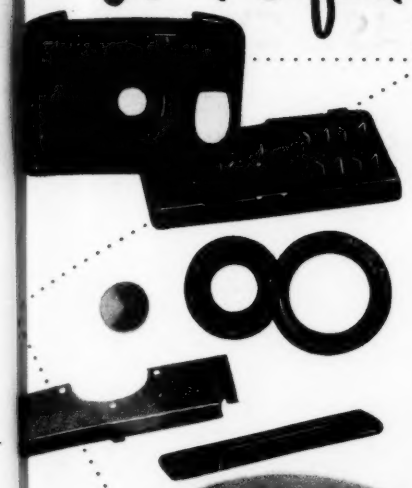
SPECIFICATION

MACHINE CYCLES PER HOUR (Max.)	1200
APPROXIMATE WEIGHT OF MATERIAL PLASTICIZED PER HOUR (Dependent upon weight per shot and material used)	22 lb.
Area of Injection plunger	2·074 sq. in.
Pressure per square inch on material at end of plunger	9100 lb.
Total pressure on Injection plunger	18,850 lb.
Mould opens (adjustable)	6-9 in.
Maximum die space	7½ in.
Minimum die space	3½ in.
Maximum recommended casting area in mould	15 sq. in.
Size of die plates	16 x 10 in.

DOWDING & DOLL LTD.

346 KENSINGTON HIGH ST., LONDON, ENGLAND. 'GRAMS: ACCURATOOL WESTERN LONDON

A Perfect Combination!

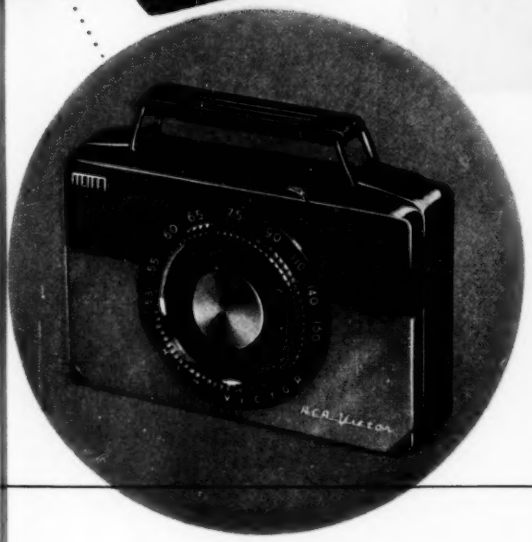


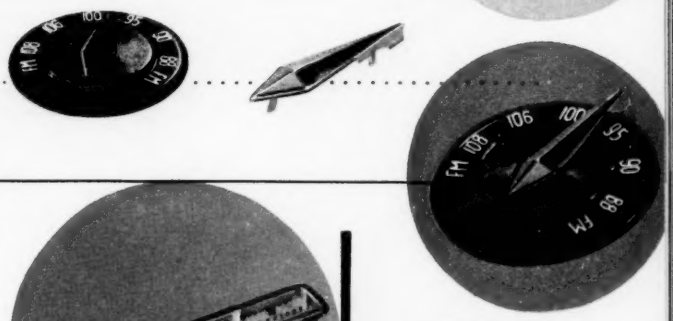
METALS AND PLASTICS BY *Santay*

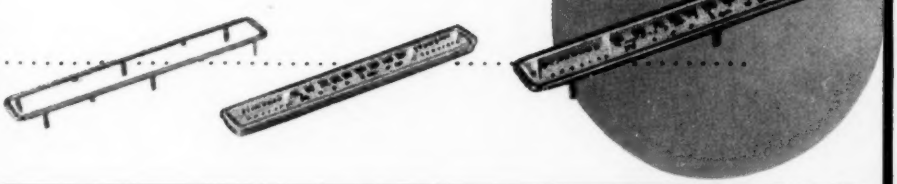
Metal stampings and plastics have proved invaluable in hundreds of industrial and consumer products when they are used individually. However, many products require a combination of both to fulfill specifications of engineering and design. Santay not only offers individual metal stampings and individual plastic moldings but *the perfect combination* of metal and plastic formed into one part . . . completely finished *in one plant, under one roof.*

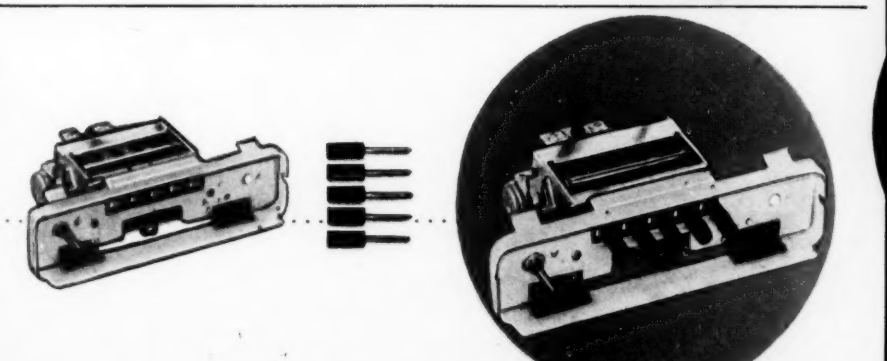
What does this mean to you? *First,* it means you save time, trouble and expense because you negotiate with only one company. *Second,* it means your job is finished quicker and better. Completion in one plant affords an uninterrupted flow of production and results in an *improved finished product for you.*

Write today for complete information.



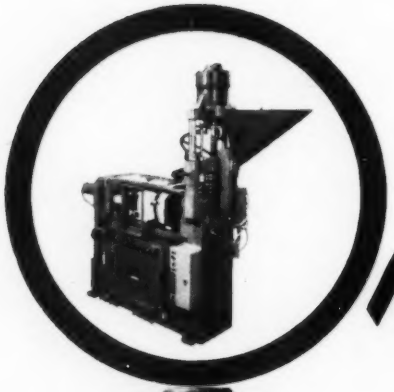






SANTAY CORPORATION 355 N. CRAWFORD AVE, CHICAGO 24, ILL. PHONE SACRAMENTO 2-2900 • REPRESENTATIVES: George H. Timmings & Co., 1802 N. Damen Ave., Chicago 47, Ill. • Queisser Bros., 110 E. 9th St., Indianapolis 2, Ind. • Stanley J. Roberts & E. H. Vannorwick, 5-259 General Motors Bldg., Detroit 2, Mich. William S. Richards Company, No. 2 S. Brentwood Blvd., Clayton, St. Louis 5, Mo. • E. J. Edmunds, 101 No. Lexington, Havertown, Penn.

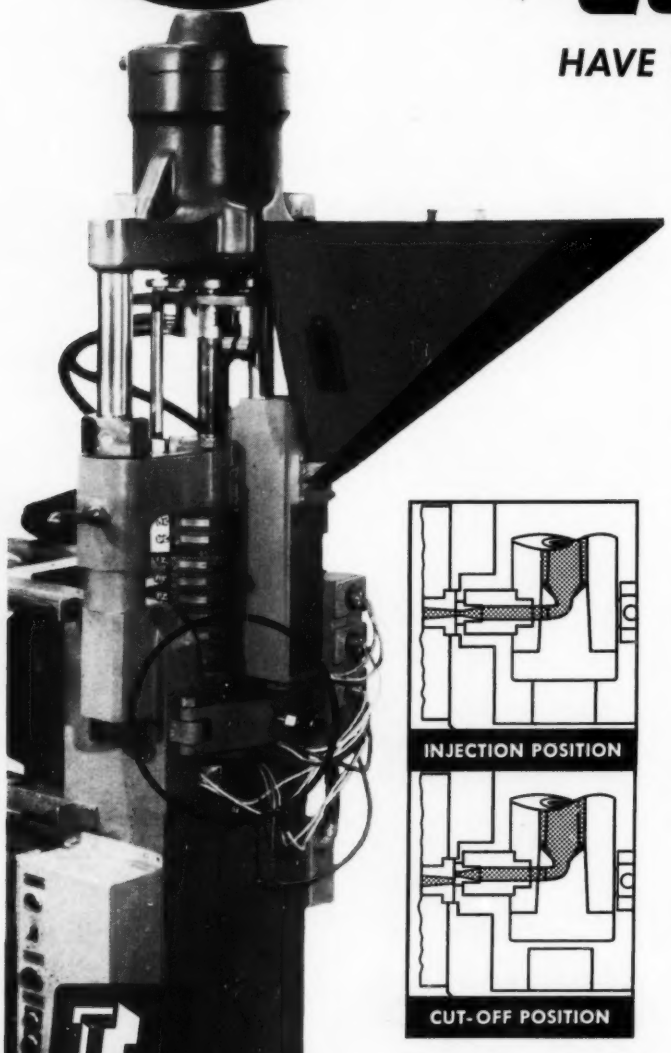
INJECTION MOLDING · METAL STAMPING · ELECTRO-MECHANICAL ASSEMBLIES



Only LESTERS

HAVE THE PATENTED, TIME-TESTED

NYLON CUT-OFF ATTACHMENT



Unlike other thermoplastics, nylon drools when heated. The Nylon Cut-Off Attachment on Lester machines is the *only* positive shut-off available for controlling this nozzle drool. No filter plates, no screen packs, no hypersensitive temperature control—*just routine injection molding!* Whether the part sticks, inserts are being loaded, or cavities are being lubricated—whatever the reason for cycle delay—the operator has no added anxiety about nylon drool and possible mold damage.

Here is a partial list of the many injection molders where, at this moment, tons of nylon are being molded on Lester 4, 8, 12, and 20 oz. machines using the Nylon Cut-Off Attachment:

Autograf Brush & Plastics Co. . Watervliet, Conn.
Canadian General Electric Co., Ltd. . Cobourg, Ont.
Central Molded Products Co. . . Chicago, Illinois
Danielson Manufacturing Co. . . Danielson, Conn.
Engineered Nylon Products . South Bend, Indiana
Foxval Molded Plastics Corp. . South Elgin, Illinois
Friden Calculating Mach. Co., Inc., San Leandro, Cal.
Nylon Molded Products Corp. . Garrettsville, Ohio
Prophylactic Brush Co. . . Florence, Massachusetts
Quinn-Berry Company . . . . Erie, Pennsylvania
Sinko Tool & Manufacturing Co., Chicago, Illinois
Waldes-Kohinoor, Inc. . . Long Island City, N. Y.

LESTER INJECTION MOLDING MACHINES

REPRESENTATIVES

New York . . . . Steven F. Krould
Detroit . . . . . Thoreson-McCosh
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Cleveland . . . . . Don Williams
Coral Gables . Morton Machinery Sales
Seattle . Perine Machinery & Supply Co., Inc.
Cincinnati . . . Index Machinery Corp.
Los Angeles . . . Seaboard Machinery Co.
San Francisco . . . . . J. Fraser Rae
St. Louis, Milwaukee . . . . A. B. Geers
Providence . . . . Sydney W. Lohman

FOREIGN

Toronto, Canada . . Modern Tool Works, Ltd.
London, England . . . Dowding & Doll, Ltd.
Sydney, Australia . . . Scott & Holladay, Ltd.
Japan . . . . Okura & Co., New York, Inc.

distributed by LESTER-PHOENIX, INC., 2621-N CHURCH AVENUE • CLEVELAND 13, OHIO

I.C.I. PLASTICS

Serve the Flooring Industry

This unusual view of the offices of the World Transport Agency Ltd. shows something rather new in floors—a tiled floor made from 'Corvic' p.v.c. Floors made from p.v.c. are hard-wearing and colourful. They do not mark, they are fire-resistant and (though the property is hardly called for in this application!) they are oil and acid-resistant into the bargain.

Another I.C.I. plastic in the service of the flooring industry is 'Alkathene' polyethylene foil—used to provide a chemical-resistant underlayer to chemical plant flooring, thus protecting joists and beams from the danger of corrosion.

'Corvic' and 'Alkathene' are registered trade marks in the United Kingdom, the property of Imperial Chemical Industries Ltd.

IMPERIAL CHEMICAL INDUSTRIES LIMITED

Plastics Division, Black Fan Road, Welwyn Garden City, Herts. England.

U.S.A. enquiries to:—**J. B. HENRIQUES INC.,** *521 Fifth Avenue, New York 17, N.Y.*

P.544m

it pays *up to 50%* to think

FIRST

about last operations

Parker-Kalon Self-tapping Screws have been cutting assembly costs of millions of metal and plastic products for over 35 years. Yet, today, thousands of manufacturers, who could gain the same benefits, still use such slow-down fastening methods as machine screws in tapped holes, bolting, and riveting. Why?

The reason is that too many product engineers think *last* about assembly because it is a final operation, then follow habit or custom in specifying fasteners.

Best way to make sure of savings you have been missing is to think *first* about fastenings . . . compare methods for simplicity, speed and security. Records show that in 7 out of 10 cases, P-K Self-tapping Screws show substantial savings, often up to 50% and more.

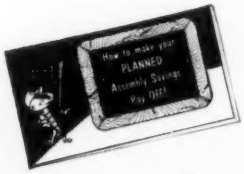
A P-K Assembly Engineer will help you get the facts you need. He'll call at your request. Parker-Kalon Corporation, 200 Varick Street, New York 14.

P-K Type A
— the FIRST Self-tapping Screw

The INDUSTRIAL DISTRIBUTOR steers your Supply Dollars to the best values.

PARKER-KALON®

The Original **SELF-TAPPING SCREWS**



GET THIS GUIDE TO LOWER ASSEMBLY COST

Filled with facts you need to plan for lowest cost when you plan assemblies. Ask your P-K Distributor, or write Parker-Kalon for Form 475-D.

This mark △ on every P-K Self-tapping Screw identifies it as genuine.

Cabinet molded for Zenith Radio Corp., Chicago

Skillful Molding Creates

ITS NEWEST CABINET MEMBER

This cabinet which we molded for Zenith's new "Tip Top Holiday" portable is the latest in a long line of plastic cabinets molded by Mills. In shape—size—color—these cabinets have varied as widely as the products for which they were made.

All were alike however in one respect. Each was engineered and molded so that its attractive, sales appealing appearance was matched by sturdy durability.

The fact that we received additional cabinet molding jobs as well as other molding orders from the same clients proves we can be depended upon for top quality every time.

Let us show you today how our unique combination of sound engineering—*careful, correct* material selection and skillful molding can create a better plastic product for you.

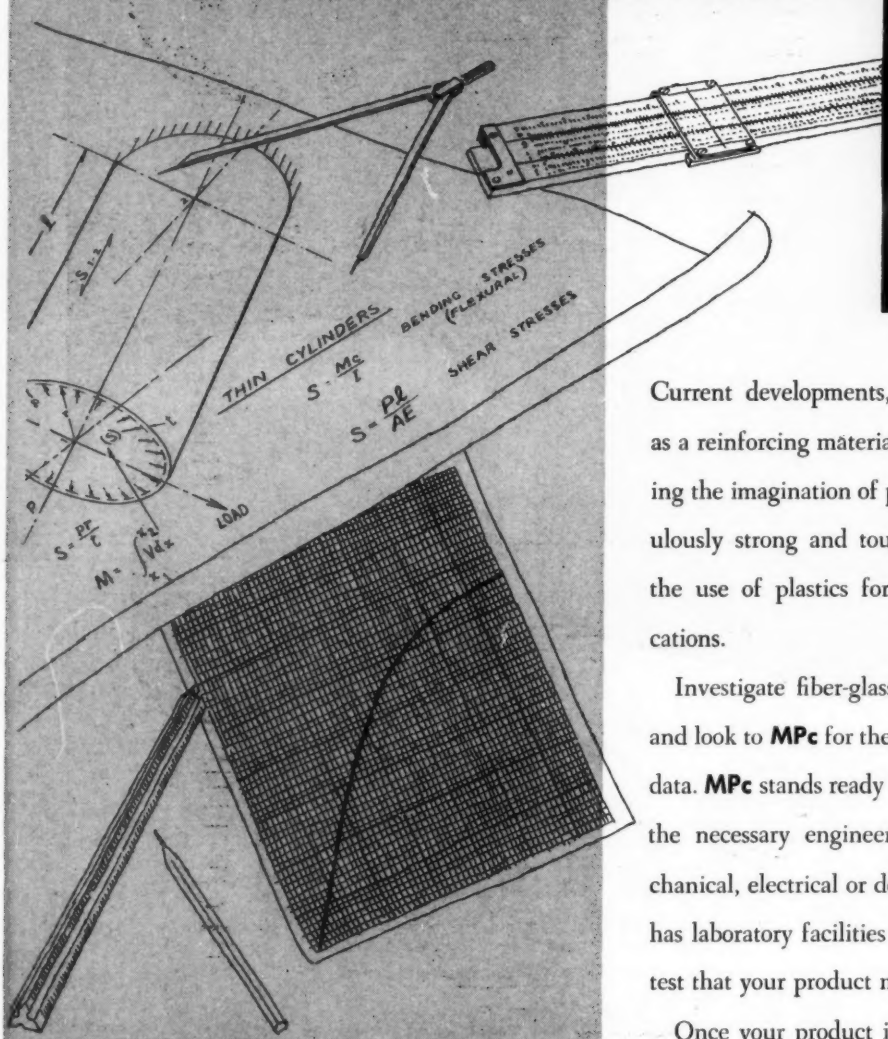
*Write on your letterhead for the new Injection Molded and Extruded Plastics Catalog. Or, for detailed information about ~~CELLULOSE ACETATE~~ *, piping, tubing and fittings, write for circulars containing data and illustrations.*
**Trade Mark Registered.*

ELMER E. MILLS CORPORATION

INJECTION MOLDED and EXTRUDED Thermo-Plastic Materials Including Cellulose Acetate, Cellulose Acetate Butyrate, Acrylates, Methacrylates, Styrenes, Vinyls, Vinylidene Chloride, ~~CELLULOSE ACETATE~~ *

2930 NORTH ASHLAND AVENUE • CHICAGO 13, ILLINOIS

Look to MPc for Engineering Assistance on Fiber-Glass Reinforced Plastics



Current developments, employing fiber-glass as a reinforcing material for plastics, are exciting the imagination of product designers. Fabulously strong and tough, fiber-glass permits the use of plastics for countless new applications.

Investigate fiber-glass reinforced plastics... and look to **MPc** for the necessary engineering data. **MPc** stands ready to assist you in making the necessary engineering evaluations...mechanical, electrical or design application. **MPc** has laboratory facilities to make every type of test that your product may require.

Once your product is past the engineering stage, **MPc** offers unexcelled tooling and production facilities. Address your inquiry to MOLDED PRODUCTS, 4535 W. Harrison St., Chicago 24, Ill.

MOLDED PRODUCTS

DIVISION OF
ADMIRAL DISTRIBUTORS, INC.
4535 W. Harrison St., Chicago 24, Ill.

...Pace-Makers in Plastics Molding

MEMBER: COMMITTEE ON LARGE PLASTIC MOLDINGS OF THE SPI

PACKAGE EASILY AND
ECONOMICALLY FORMED

PACKAGE DISPLAYS BETTER,
SELLS PRODUCTS FASTER

ELECTRONIC
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4

PACKAGE SEALS AGAINST
DAMAGE AND DISCOLORATION

designed to sell with

HERCOCEL

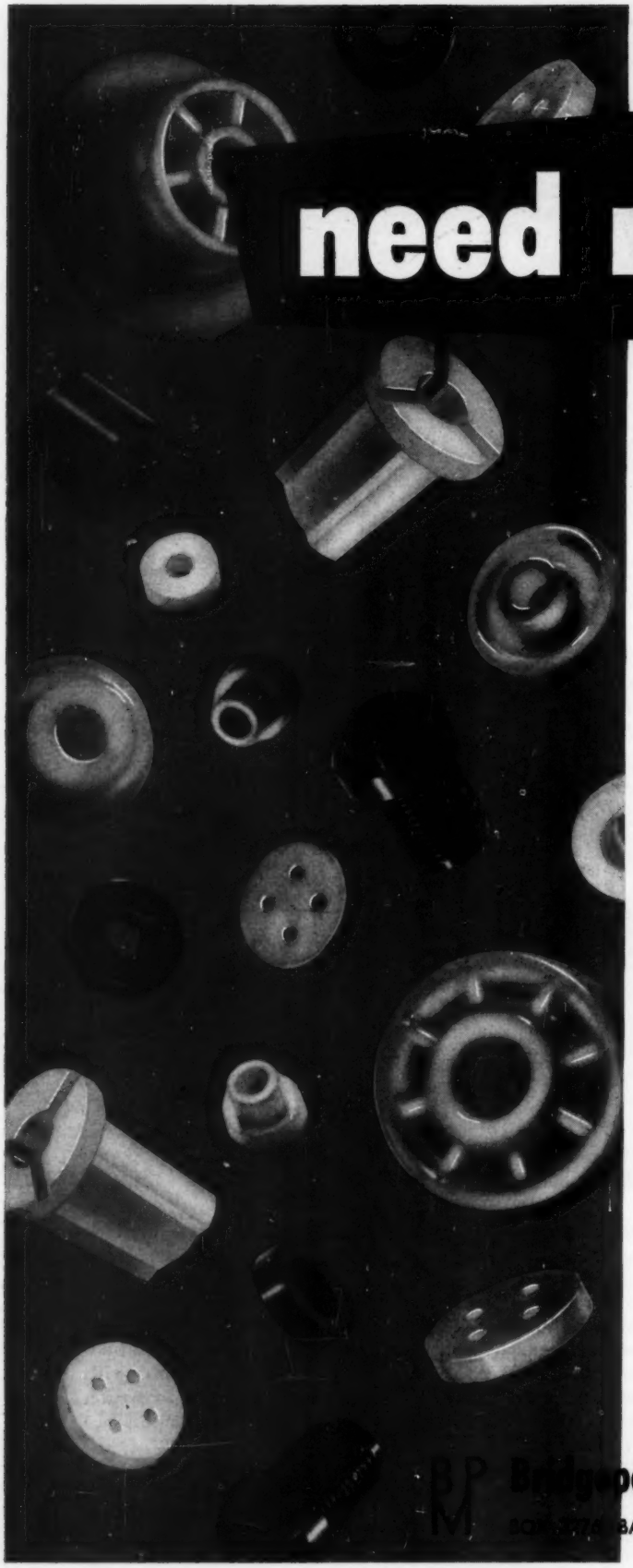
by GAIR and US

*A trademark of U. S. Rubber Company.

A protective plastic covering for golf balls called Plasti-Guard* is the latest thing in sporting goods packaging. A tough, transparent display as well as a package, it attracts sales and keeps contents sealed, electronically, against damage and dirt until used. Balls can be removed one at a time without opening the other Plasti-Guards in the set. Developed by Robert Gair Co. and United States Rubber Company, this new triple package is now being formed with Hercocel A, exclusively for U. S. Rubber. For complete information on Hercocel plastics and on the design and technical assistance offered by Hercules, write:

HERCULES POWDER COMPANY
INCORPORATED
Cellulose Products Department, 916 Market Street, Wilmington 99, Del.

CP53-5



need nylon?

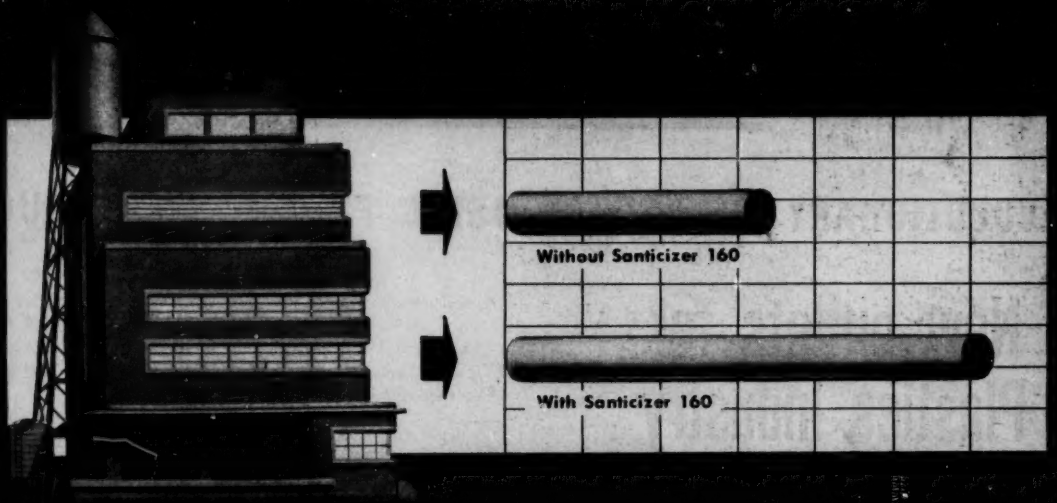
Call on the specialized **BRIDGEPORT** skills and services to give you the ultimate in nylon molding

When you require the amazing durability and other well-known properties of nylon, you need the services of a specialist in nylon molding. Bridgeport has been successfully supplying nylon components like those shown for leading manufacturers for many years. Perhaps we can help you, too. Write . . .

Bridgeport Moulded Products, Inc.

BARNUM STATION BRIDGEPORT, CONN.

Increase in Output 80% · No Increase in Equipment with SANTICIZER 160



The owner of a vinyl extrusion plant, in a southeastern state, was faced with a major problem: *How to increase production most efficiently?*

He called in Monsanto technical and sales personnel. They went into his plant . . . worked side by side with his technicians. They varied fillers and screw speeds, replaced one monomeric and one polymeric plasticizer with Santicizer 160. Their recommendations produced these results:

- *Production capacity increased 80% . . . with no increase in equipment.*
- *Cost of raw materials cut one cent per pound.*
- *Smooth surface and trueness of contour fully maintained.*
- *No loss in tensile strength, softness, low temperature flexibility or other important properties.*

Find out what Santicizer 160 or Santicizers 140 and 141—which are also fast processing plasticizers—can do for you. For information on prices, delivery and performance, call the nearest sales office or MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 800 North Twelfth Blvd., St. Louis 1, Missouri.

Santicizer: Reg. U. S. Pat. Off.

PLASTICIZERS

MONSANTO
CHEMICALS – PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

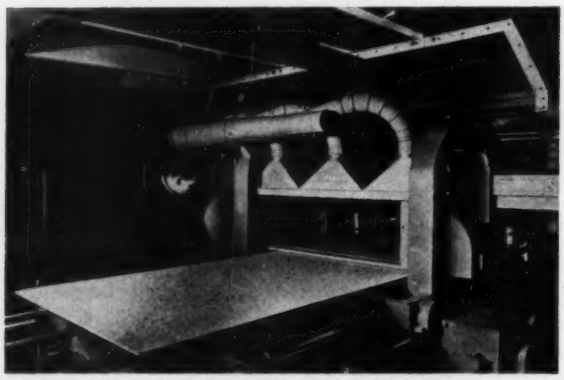
First Automatic Press to produce resin-bonded board in continuous strip

REVOLUTIONARY METHOD OF USING FOREST BY-PRODUCTS

New outlets for Plastics Industry

THE MANUFACTURE of resin-bonded wood board by a continuous process has been called a "revolutionary development" in the lumber industry. For the Plastics Industry too the perfection of the Bartrev Press, the first automatic press to produce board in continuous strip, is an important event.

A single Bartrev Press will consume between 800 and 1200 tons of solid resin a year. 'Bartrev,' the new product, provides an excellent core material for a wide variety of finishes. Plastic surfacing of different kinds can be applied, including high pressure laminates.



'Bartrev' emerging from the press in a continuous strip

HOW 'BARTREV' IS MADE

The Bartrev Press consists essentially of two endless stainless steel bands backed by heated platen chains. A carpet of wood/resin mixture is fed onto the lower steel band which carries it under the electrodes of a high frequency heating unit into the pressure zone of the Press. The moving platen chains compress the board to the required thickness and hold it under pressure for a period of approximately 90 seconds during which the resin is fully cured. A rigid board emerges from the Press and is cut to required lengths by an automatic saw.

☆ ☆ ☆

BIRTH OF A NEW INDUSTRY

With world consumption of lumber steadily rising (the demand for plywood and board has trebled every three years since the war), and with 60% of all felled timber going to waste, Bartrev machines will be in demand wherever lumber is produced or building boards required. The process will become the basis of a new world-wide industry and the speed and economy of continuous automatic production must introduce an entirely new element into the existing board industry.

The Bartrev invention is as revolutionary in the lumber industry as was the invention of continuous milling for steel, paper or aluminum.

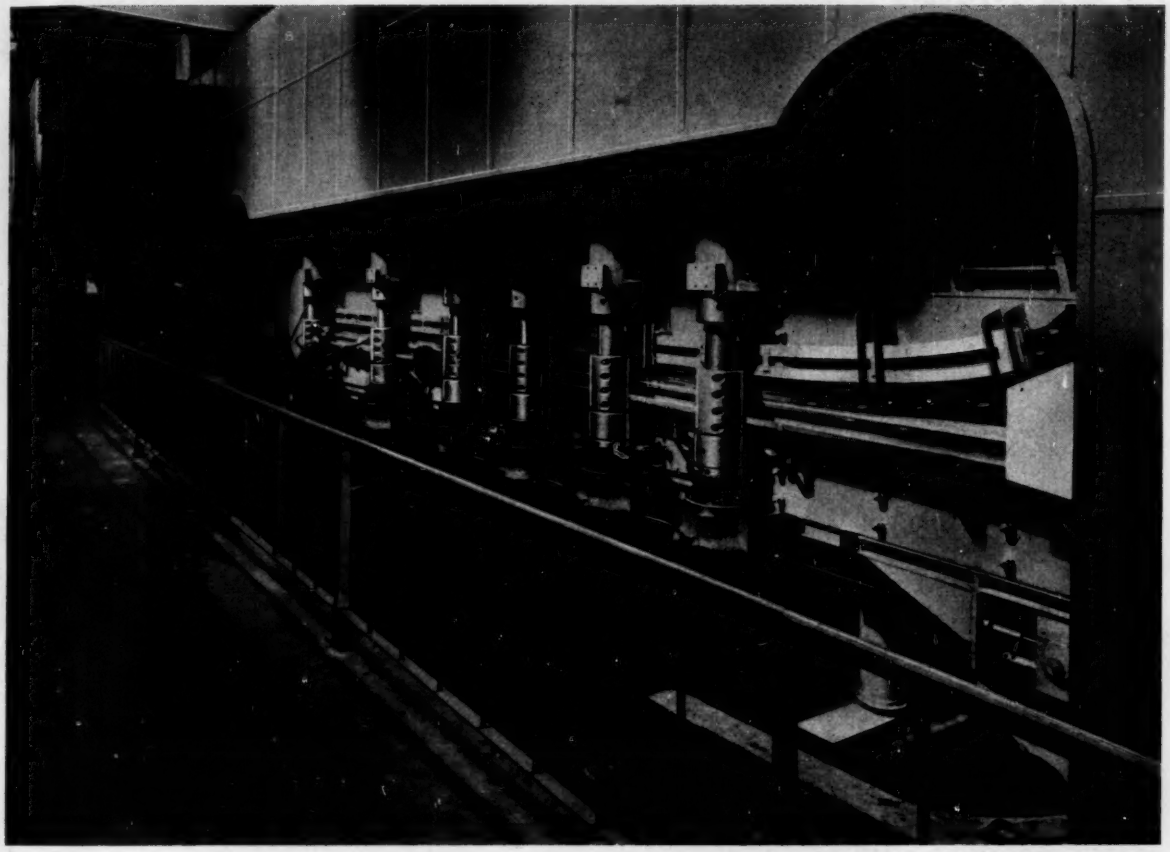
Production will moreover be a natural and profitable development not only in those parts of the world that are rich in timber but in any area where the processing of timber entails a problem of waste.

☆ ☆ ☆

COMMERCIAL PROSPECTS

Two economic facts make the Bartrev Press invaluable to all those engaged in the use of wood in any form:

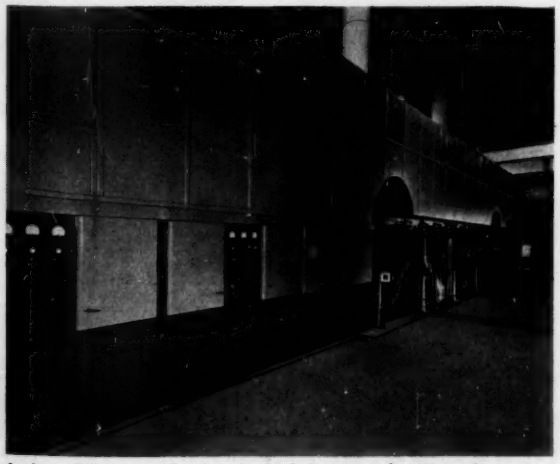
(1) The supplies of accessible timber are diminishing and (2) the demand for lumber is increasing rapidly. It is true that large unexploited forests still exist; but to get at them and to them will take time and money; and even then those who exploit them will want to do so in the most efficient and economical way. In this they will find no more powerful ally than the Bartrev Press, which converts "waste" from forest, mill and factory into a sound commercial product. The usual problem of the rising cost of raw materials scarcely arises, because the raw material of 'Bartrev' is continually accumulating.



The Bartrev Continuous Press

25 MILLION FEET A YEAR

A single Bartrev Press produces 16,000 tons of board a year. Making ⅜ inch board at 15 feet a minute, this is equivalent to 25 million square feet a year. The range of thickness of 'Bartrev' is 3/16 inch to ¾ inch. Standard width is 48 inches. Length as required. The effective production area needed for the Bartrev Press and auxiliary plant is only 6,000 square feet.



A view of the press showing the high frequency heating unit

FIRST COMMERCIAL BARTREV PRESS IN OPERATION

The first Bartrev Press is in operation in Essex, England. Orders for the Press can now be accepted. Each Press will be delivered as a complete package unit and specifications for all necessary auxiliary plant will be provided. Its installation will be supervised by Bartrev engineers and specialists.

☆ ☆ ☆

PATENTS

The Bartrev Press and Process are covered in the U.S A. by United States Patent Nos. 2,580,200, 2,602,960, 2,623,239 and in Great Britain by British Patents Nos. 605,806, 647,109, 665,276, 665,275, 684,350 and in many countries throughout the world. Other patent applications pending.

ARIES FIBERBOARD CORPORATION

North American Representatives for BARTREV LTD.
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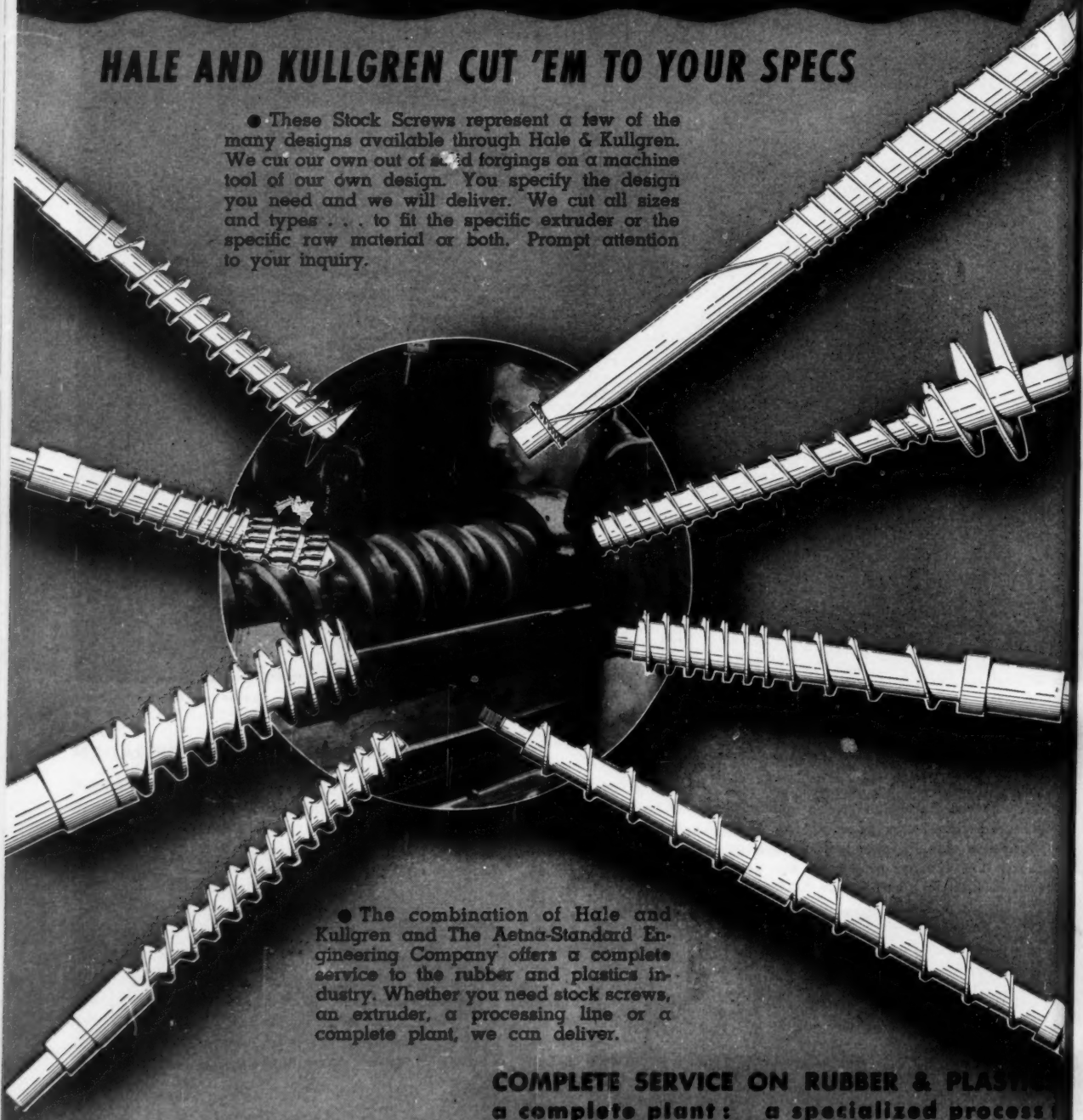
WHAT *Design* EXTRUDER STOCK SCREWS DO YOU NEED?

HALE AND KULLGREN CUT 'EM TO YOUR SPECS

● These Stock Screws represent a few of the many designs available through Hale & Kullgren. We cut our own out of solid forgings on a machine tool of our own design. You specify the design you need and we will deliver. We cut all sizes and types . . . to fit the specific extruder or the specific raw material or both. Prompt attention to your inquiry.



● The combination of Hale and Kullgren and The Aetna-Standard Engineering Company offers a complete service to the rubber and plastics industry. Whether you need stock screws, an extruder, a processing line or a complete plant, we can deliver.

COMPLETE SERVICE ON RUBBER & PLAS
a complete plant: a specialized process
an engineering service or individual machine

National Erie products for the Plastic and Rubber Industries • Extruders • Simplex Doors for Autoclaves • Mills and Hydraulic Presses.

This old and well-known line of machinery was acquired March 1, 1952, by The Aetna-Standard Engineering Company. They are manufactured in their Warren, Ohio, and Ellwood City, Pa., plants. The sales and engineering of the National Erie line is the responsibility of Hale and Kullgren, Inc., Akron, O.

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MANUFACTURING by

Aetna-Standard

THE AETNA-STANDARD ENGINEER
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STRIP HEATERS

In straight lengths, formed or "finned" for conduction or convection heating. Industry's rugged and versatile heat source for many uses.

CARTRIDGE HEATERS

Installed in an instant in drilled holes for heating dies, platens, moving parts, rolls, molds, etc. Types available for immersion heating in liquids.

SHEATHED IN METAL FOR STRENGTH—INSULATED ELECTRICALLY FOR SAFETY

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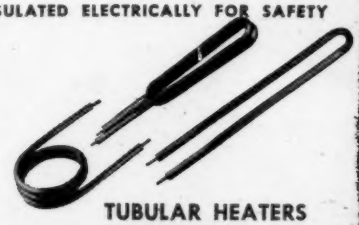
For heating water, oil and other liquids. Wide variety of types and sizes for portable or permanent installations, with or without built-in thermostats.



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Straight lengths or tailored to any desired shape. For heating liquids, solids or gases by conduction, convection or radiation. Many sheath types.

Your LOW COST SOLUTION to processing heat problems!

Chromalox Electric Heaters give you quick, on-the-spot heat for a wide range of uses. They provide dependable, efficient, economical around-the-clock service in applications requiring continuous, accurately controlled temperatures. Thousands of plants in all industries have found Chromalox Heaters the low cost solution for heating liquids and gases; for heating dies, platens, moving parts; for superheating steam and pre-heating oil; in fact—for almost every industrial application using heat.

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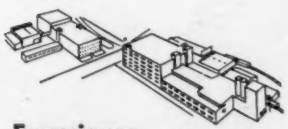
Over 15,000 types, sizes and ratings fill most applications needing heat up to 1100° F.

Engineering . . .

Research, development and technical personnel provide a vast reservoir of industrial heating know-how.



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World's largest manufacturer of electric heating units exclusively. 35 years of designing and manufacturing skills.

Service . . .

Over 130 field engineers in 36 key cities give on-the-job assistance and counsel.

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Electric Heat for Modern Industry

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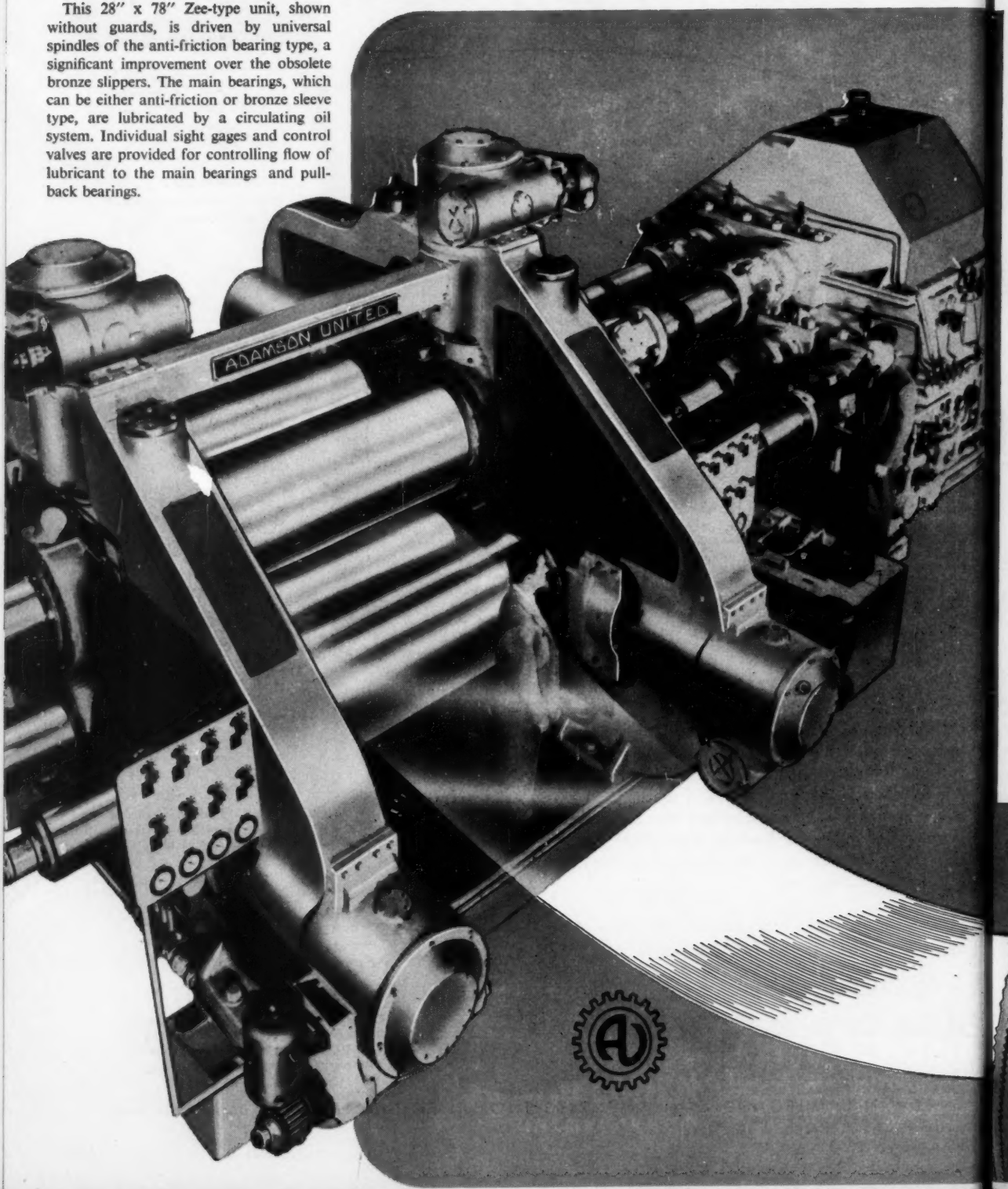
Catalog 50 is a storehouse of valuable information and data on many of the 15,000 Chromalox Electric Heating Units. Write today for your copy.

EDWIN L. WIEGAND COMPANY, 7503 THOMAS BOULEVARD, PITTSBURGH 8, PA.

* ANNOUNCING a new ADAMSON UNITED..

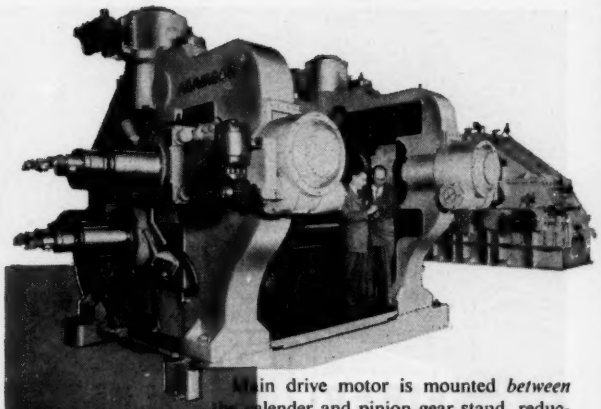
This 28″ x 78″ Zee-type unit, shown without guards, is driven by universal spindles of the anti-friction bearing type, a significant improvement over the obsolete bronze slippers. The main bearings, which can be either anti-friction or bronze sleeve type, are lubricated by a circulating oil system. Individual sight gages and control valves are provided for controlling flow of lubricant to the main bearings and pull-back bearings.



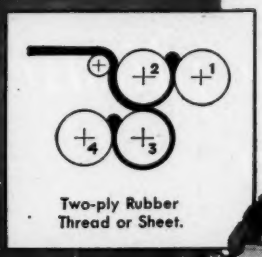
Zee-Type

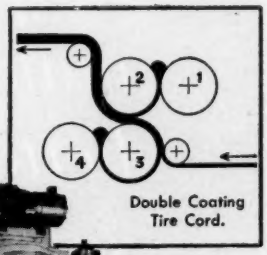
PRECISION

CALENDER



Main drive motor is mounted *between* the calender and pinion gear stand, reducing overall length significantly. Gage adjusting equipment is unitized construction, assuring positive alignment, with double enveloping worms and worm gears mounted in anti-friction bearings.



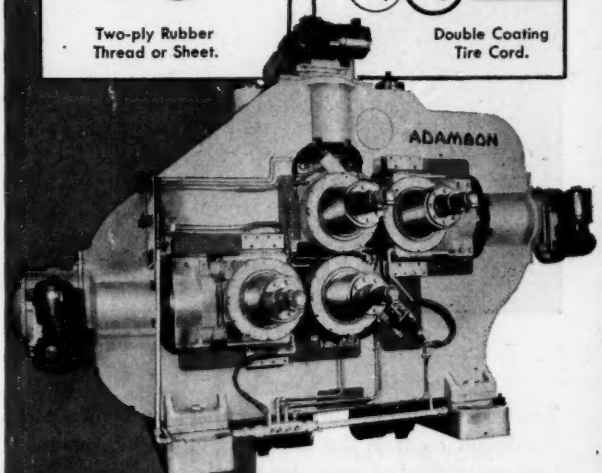


The new Adamson 4-roll calender is a completely modern Zee-type unit, especially designed for double-coating tire cord or producing two-ply laminated material. The improved features available on this unit greatly increase the accuracy of calendering operations, and assure a more uniform product with substantial savings in material. Higher production speeds can be obtained; and crown compensating equipment provides uniform transverse gage under varying conditions of operation.

This high-speed unit incorporates a separate pinion gear stand which encloses all drive gears and connecting gears, driving the rolls individually through universal couplings. The peripherally drilled rolls are accurately controlled by a pressurized circulating water temperature regulation system.

In addition to the unit shown, a modified calender, incorporating crossed axis equipment on only the #1 or the #4 roll is available for plastic film or sheeting. Adamson also manufactures a 24" Zee-type calender, along with a special 6-roll double Zee-type unit.

We invite your inquiries.



Both offset rolls (#1 and #4) are "crossed" in the vertical plane by motorized adjustments allowing operator to compensate for deflection of the rolls. The operator can add or subtract crown, in effect, by changing the amount of crossing of the two offset rolls with respect to the two back rolls. Selsyn equipment and counters are provided for indicating the exact vertical position of each end of the crossed rolls.

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The basis of all Pittsburgh Fiber Glass products is a continuous filament of glass. Pittsburgh controls the diameters of these filaments to a high degree of fiber uniformity. Packaging is also closely controlled. The manufacturer of fiber glass reinforced plastics thus obtains these advantages:

- Specifications for reinforcing cloth can be adhered to more easily by weavers using Pittsburgh Yarns.
- Roving is packaged with a uniform tension that improves automatic feeding in preform operations. It also is a desirable factor when used for such products as bar stock and fishing rods.

You are invited to obtain complete information, including the names of weavers using Pittsburgh Yarns. Pittsburgh Plate Glass Company, Fiber Glass Division, 420 Fort Duquesne Boulevard, Pittsburgh 22, Pa. District Sales Offices: Chicago, Cincinnati, Cleveland, Detroit, New York, Washington.

Roving packaged to meet your needs

In addition to standard 35-pound, 60-ends packages, Pittsburgh Roving is also supplied in 12-ends and 24-ends; on special order, in any number of ends up to 60. Either inside or outside winding is available.

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You saw this ad in Tool Engineer, Machinery, Modern Machine Shop, American Machinist, Iron Age.

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TOOL STEEL

Our reputation was built on tool steel . . . and that means that when Crucible puts mold steel in the same class as tool steel — *you* benefit!

You benefit these ways: we've assigned an experienced metallurgical staff to help you with your plastic mold problems; we back every pound of steel with over 50 years of specialty steel leadership, and we have stocks available from warehouses strategically located from coast to coast.

Crucible mold steel *is* better. It's tool steel.

WRITE TODAY FOR YOUR TOOL STEEL SELECTOR

Get your copy of the unique Crucible Tool Steel Selector — a quick twist of the dial gives you the right tool steel for the right job. And will help in the selection of mold steel. Selector has 9-inch diameter; printed in 3-colors.

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Nixon supplies the most complete range of materials • properties • colors • sizes

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In step with the rapid developments which are being made, Nixon Nitration Works—one of the first names in plastics—now offers an extremely wide selection of formable rigid thermoplastic sheets.

These materials can be used for vacuum forming or deep drawing, to yield products which are otherwise too costly or complex to manufacture. Your local Nixon representative can advise you regarding manufacturing techniques and the proper materials for the applications you contemplate.

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The modern home laundry is the housewife's pride, and plastics have had much to do in dressing the engineer's triumphs with artistic beauty. In common with other manufacturers of domestic appliances, producers of washers, dryers, and ironers have paid generous tribute to the practical and versatile ability shown by ERIE, pioneer in custom injection molding.

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Wellington Sears Spun Nylon fabric has found wide use in end product applications for the electronic and high frequency fields. The nylon staple fibers in the fabric contribute high bonding strength and provide laminates with superior insulation resistance under high humidity conditions.

These staple fiber nylon fabrics are made 28 to 72 inches wide in weights of about 5 ounces per square yard and higher. In addition, fabrics of continuous filament nylon, Orlon* and other synthetic fibers, as well as special constructions for unusual applications, are available to laminators from Wellington Sears.

While a partial list of fabrics for both laminating and coating is at the right, you will find further information and the complete answer to your fabric problem at your nearest Wellington Sears office. Make it your "headquarters for industrial fabrics."

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At ALLIED MANUFACTURING COMPANY of Worcester, Massachusetts, a leading producer of special carbide dies and tools, they demand precision finishes . . . and they rely on Elgin Diamond in DYMO-C*, the precision diamond abrasive! Precision graded for absolute particle uniformity, Elgin Diamond assures uniform, predictable results with maximum cutting speed. Operators like it, too, because it comes ready to use—there is no need for mixing or preparation of any kind. Whatever your finishing need, Elgin offers a full range of Bureau of Standards grades, each distinctly color identified to give you finer finishes, faster. Every day, more and more leading producers find that . . .

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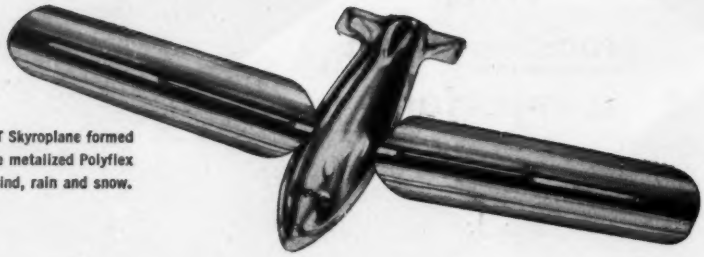
...e, a carbide curling punch for form-... the bead on flashlight casings is pre-...n finished on a rotary felt wheel at ...IED ELGIN DYMO C, grade 30, is used in this ...ration for accurate sizing in less time.

This ALLIED operator is using a rotary felt bob and ELGIN DYMO C to polish car-...bide sizing pins. Again Elgin Diamond meets ALLIED'S requirements for consistent accuracy and flawless finishes—every time.



MIRROR-BRIGHT Skyroplane formed of .0065" gauge metalized Polyflex stands up to wind, rain and snow.

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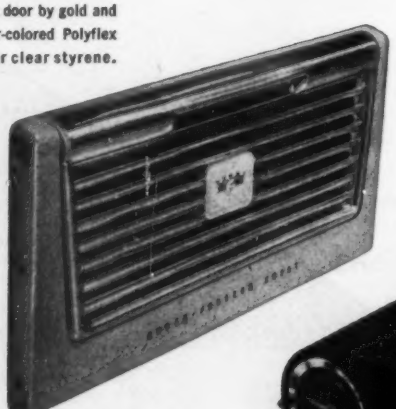
RICHNESS OF PLATED OR CLAD METALS AT A FRACTION OF THEIR COST

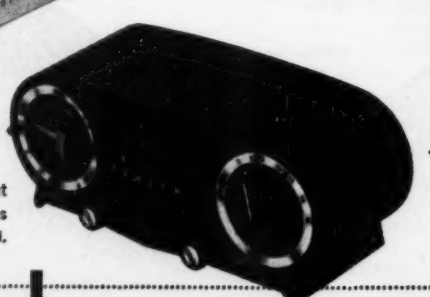
Metalized Polyflex looks, feels, even sounds like metal — but it will do things metal can't do. Yet it costs only a fraction as much. Made of the most heat resistant polystyrenes, Polyflex is strong, offers rigidity in a wide variety of gauges, and flexes easily. It lies flat and won't curl, shrink or wrinkle with age. Its mirror-like surface is water-resistant. Many different metallic colors are available in plain high gloss finish or with embossed, etched or printed patterns.

Possible uses of metalized Polyflex are infinite. If you want that money-making, polished metal look, at low cost, investigate metalized Polyflex.

ONE-WAY MIRROR effect of metalized Polyflex adds exciting feature to this Tom Corbett Space Helmet.

QUALITY LOOK is given this freezer compartment door by gold and silver-colored Polyflex under clear styrene.





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BASIC FEATURES OF POLYFLEX

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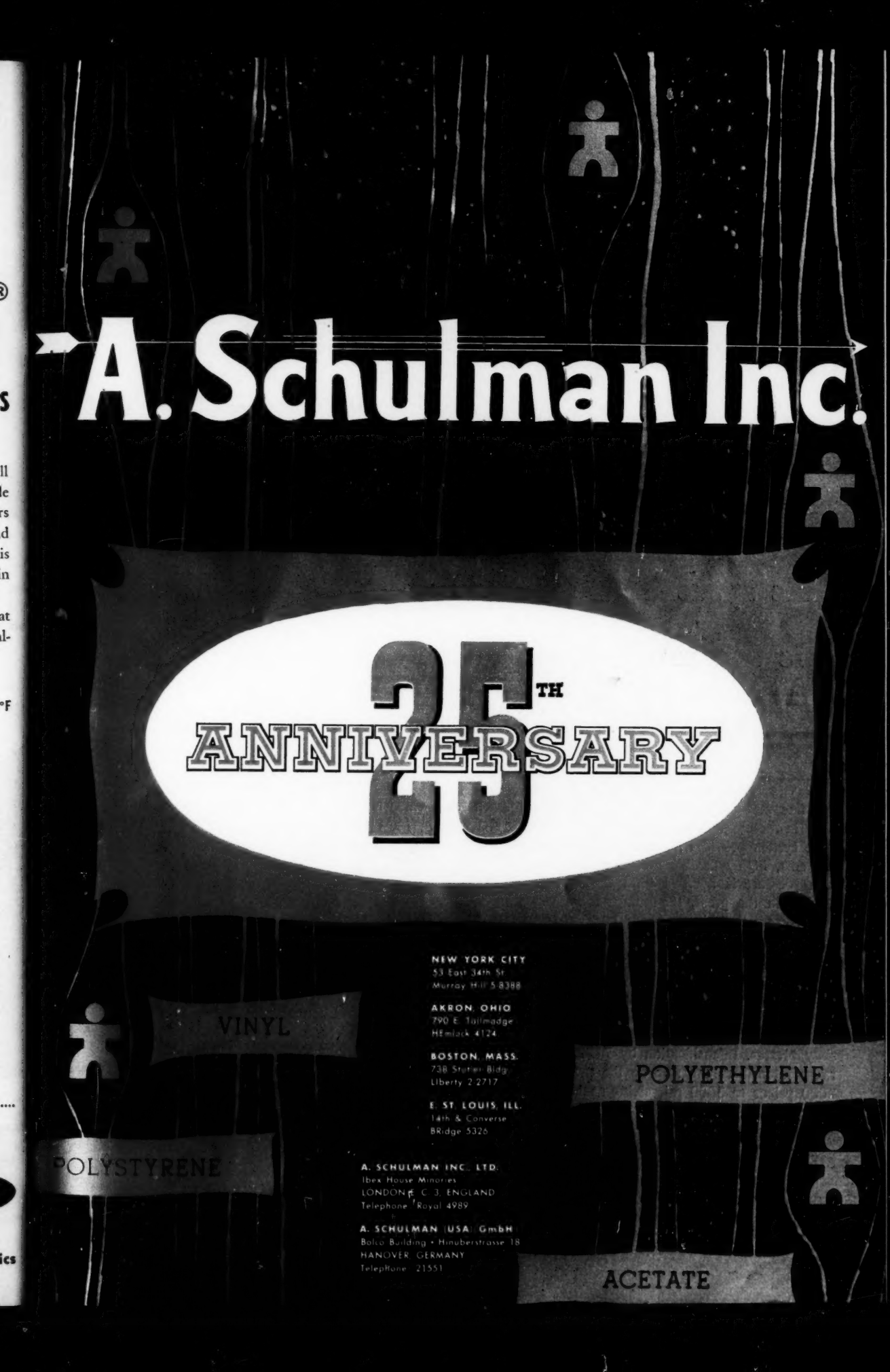
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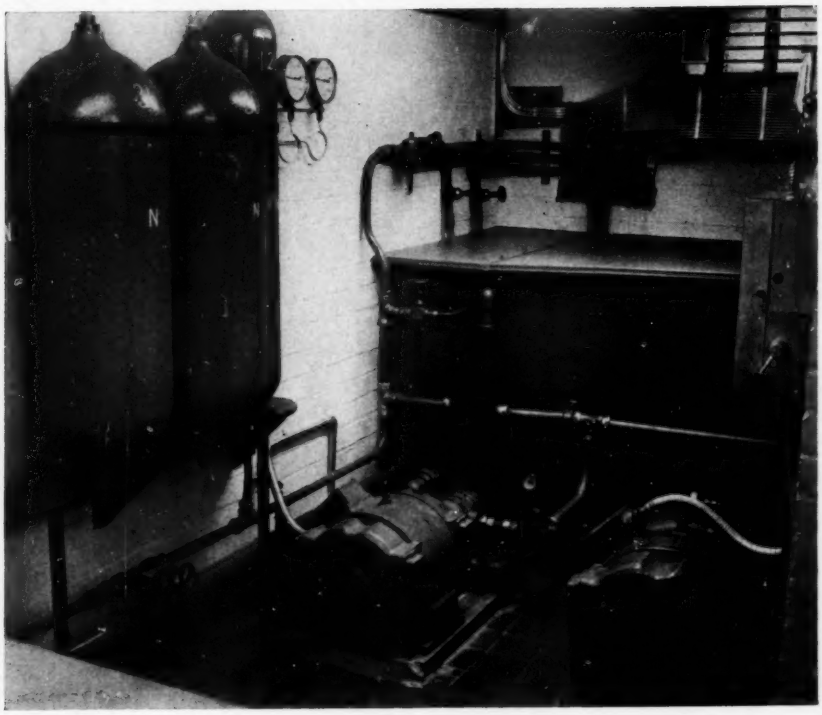

This system is the most economical ever devised to drive a press installation

BY THE NOVEL expedient of using medium line pressure (1000 psi) in combination with in-the-press intensification, the BIPEL drive system provides its users with extremely low cost, highly flexible motive power. Since high pressure is avoided until the hydraulic fluid is in the press, the pumps require less horsepower, the piping needs less thickness, and the valves and other components are lighter and less expensive to purchase, to install, and to operate.

The unit shown is one of four such, installed in a single space-saving underground chamber. A combination of any three can drive up to sixty presses. Intensification by BIPEL's dual range intensifiers can step up the pressure to 2000 psi or to 3000 psi, giving each press a range of three pressures from this single power source. The BIPEL system is protected not by a relief valve but by a novel unloading valve which does not permit circuit pressure to build up or drop beyond selected limits.

While the BIPEL drive system is designed especially for use with BIPEL "auto control" presses which reproduce any possible molding cycle automatically, it is also most advantageous with manually cycled presses. A miniature of the drive may be built into the press frame for individual press operation.

The flexibility and economy of the BIPEL drive system should be reflected in significant increases in productivity and profits. We will be pleased to send you full information on BIPEL drives for use with BIPEL presses, or for use with your present press equipment.

B·I·P GROUP

B.I.P. ENGINEERING LTD.

Aldridge Road, Streetly, Staffordshire, England

PARAPLEX P-43

in KOCH *Fiberglas Luggage*

Fiberglas luxury luggage, styled and molded by H. Koch & Sons, San Francisco, California.

Koch of California chose PARAPLEX P-43 polyester resin not only for the handsome luggage shown above, but also for special camera cases for the United States Air Force. Here are some of the properties which influenced Koch in their selection of PARAPLEX P-43:

Excellent strength—weight ratio. PARAPLEX P-43 demonstrates its great strength under severe tests, allowing Koch to advertise "lighter than leather, stronger than steel."

Resists scuffing and staining. PARAPLEX P-43 provides a durable surface that cannot be harmed by rough treatment in baggage cars and aircraft luggage compartments. It is the first truly "Worry-Free" luggage.

Outstanding color stability. PARAPLEX P-43 permits the use of a wide range of attractive colors.

Easy production. PARAPLEX P-43 is not sensitive to fluctuations in molding temperatures, can be used in all types of molding equipment. Even in resin-rich areas, PARAPLEX P-43 is highly resistant to cracking and crazing. And PARAPLEX P-43 reduces inventory problems by virtue of its long shelf life.

Where high impact strength and toughness are desired, PARAPLEX P-43 rigid polyester can be blended with the flexible PARAPLEX P-13 to give the required strengths. The PARAPLEX P-Series resins can be catalyzed for room temperature or elevated temperature cure.

Send for technical data—For up-to-date information on the PARAPLEX P-Series resins, write Dept. WW for our 21-page manual. There's no obligation.

CHEMICALS FOR INDUSTRY

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THE RESINOUS PRODUCTS DIVISION

Washington Square, Philadelphia 5, Pa.

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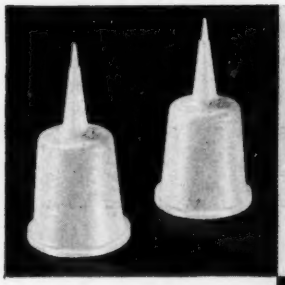
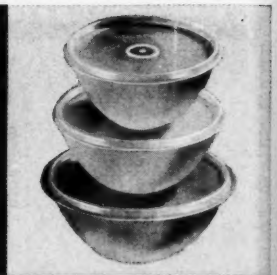
PARAPLEX *is a trademark, Reg. U.S. Pat. Off. and in principal foreign countries.*





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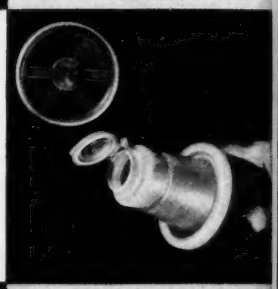

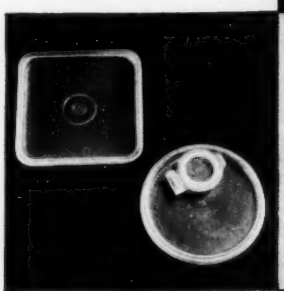

Tupper Seals are air and [illegible]-tight flexible covers. The famous Pour All and Por Top covers are designed for easy dispensing. They are made in sizes to fit all Tupperware containers.

When equipped with Tupper Seals, Tupper Canisters, Sauce Dishes, Wonder Bowls, Cereal Bowls and Funnels in various sizes are the most versatile reusable containers you have ever seen.

The logical molder for you to consult regarding that product or package of yours which is to be made of polyethylene is Tupper. Tupper has done more than any other molder to make molded polyethylene a practical reality.

Aside from having designed, patented, and promoted successful seals, closures, and dispensers for polyethylene containers, the Tupper Corporation has vast experience in *every phase* of polyethylene packaging and polyethylene injection molding. This experience will be of major importance in improving your product, in reducing your costs, when Tupper goes to work for you.

Tupper's combination of experience, technical ingenuity, and the most modern equipment is at your service for the custom molding of your product in polyethylene. You can do no better than the best ... and the best at molding polyethylene is Tupper!

TUPPER!
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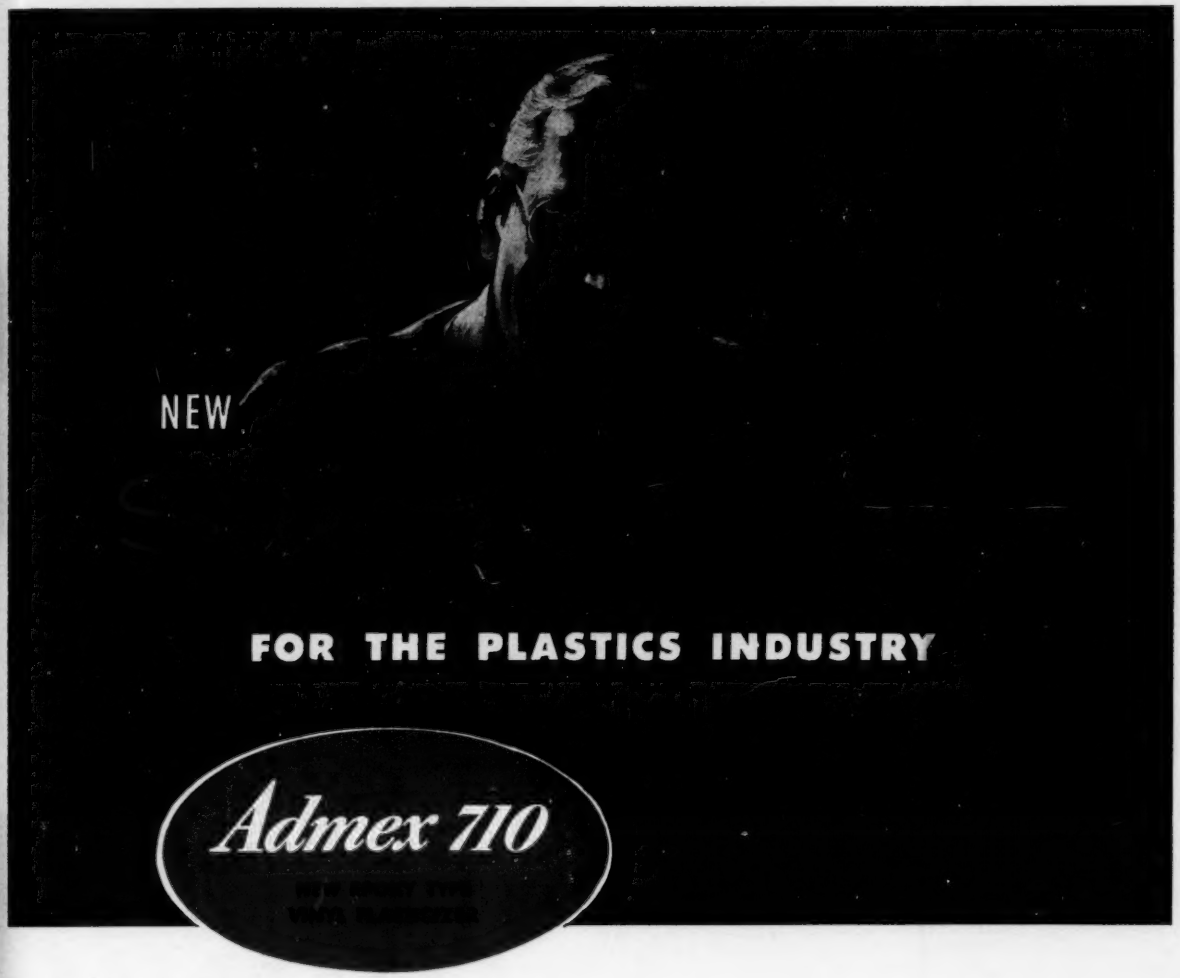

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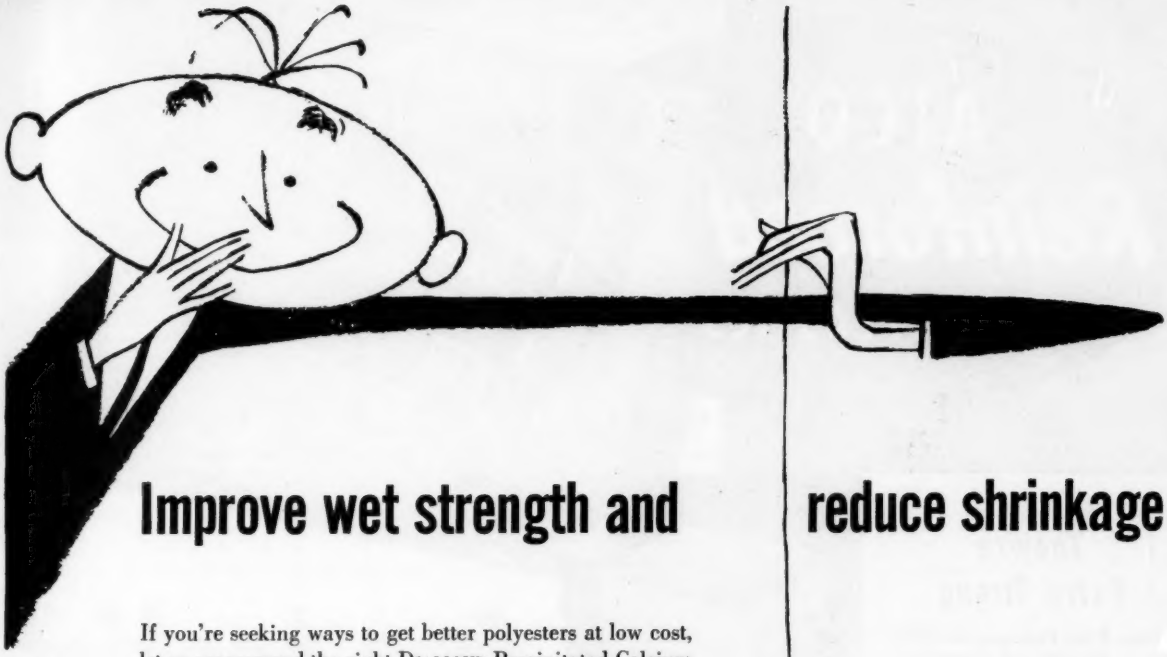

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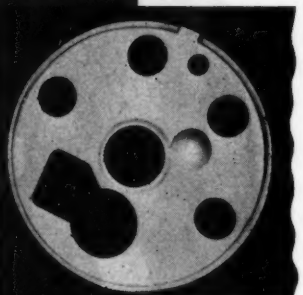

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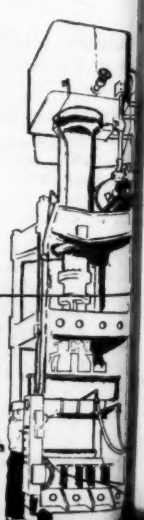
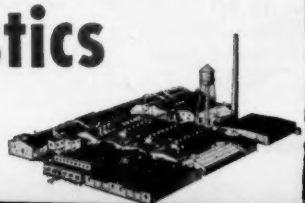


AICO plastics



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MODERN mp PLASTICS

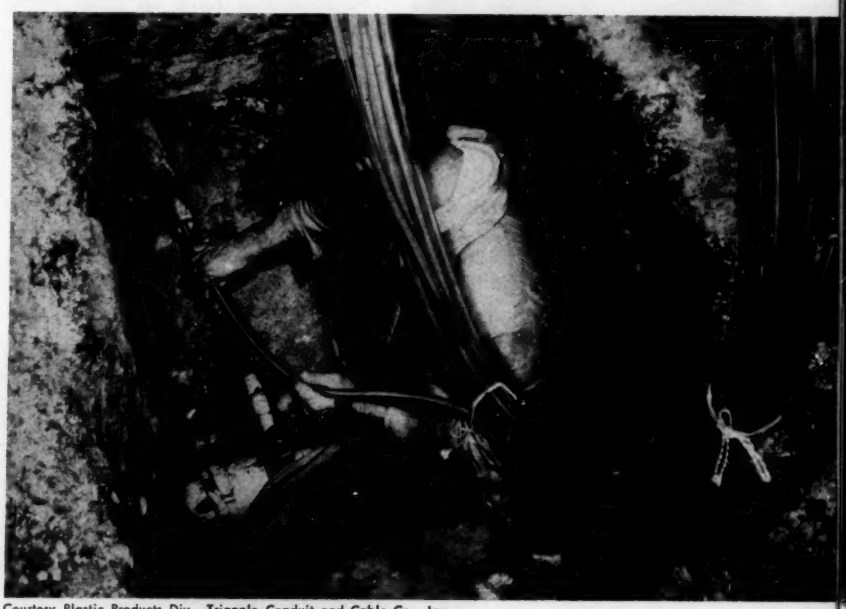
Plastics VS. Corrosion

New materials and techniques are rapidly being applied in many fields to reduce or halt the costly ravages of all kinds of corrosion

IT HAS been estimated that corrosion, in its various forms, takes a toll of approximately six *billion* dollars each year in the United States. This is in addition to the indirect loss caused by shutdowns, loss of product, cost of over-design, contamination, etc., which cannot even begin to be calculated. Corrosion of underground pipe lines alone exacts a toll of $600 million annually, according to the National Bureau of Standards.

With the establishment of The National Association of Corrosion Engineers in 1943, a clearing house was set up for activities associated with the control and prevention of corrosion. In the ten years since, a new type of technologist—the corrosion engineer—has emerged, and great progress has been made. The same period has witnessed the rapidly accelerated use of plastics as the most promising group of materials being utilized to control this age-old problem.

The anatomy of corrosion is complex. It may be generally described as an electro-chemical reaction, comparable to the functioning of a simple dry cell. An underground metallic pipe, for example, acts as an anode, or as both anode and cathode, and the soil salts, acids, and moisture form an electrolyte. Corrosive (or electrolytic) action starts whenever an electrical potential exists, a condition which may be caused by physical variations within the metal itself, by chemical concentrations, by contact between dissimilar metals, by stray direct currents, or by other factors. Such currents will "plate out" small particles of metal where it is anodic in character and weaken it. Finally, the metal is eaten through and rupture occurs.



Courtesy Plastic Products Div., Triangle Conduit and Cable Co., Inc.

Corrosion-resistant butyrate pipe can be installed by feeding it through corroded metal pipe which it will replace, reducing costly excavating operations

Plastics are no newcomers in the battle against corrosion. Some types of plastics materials have been used for many years in applications where their natural resistance to corrosion made them the logical choice. But in recent years—particularly since World War II—the development of new types of plastics has led to many new and important anti-corrosion applications.

This important new trend was

Courtesy Haveg Corp.

Sections of 23 ft. heat exchanger are molded of asbestos-plastics compound

cited by J. L. Huscher, technical director of American Agile Corp., Bedford, Ohio, at the recent 9th Annual Conference and Exhibition of the National Association of Corrosion Engineers in Chicago. "While hardly a plant in the chemical and allied field does not use plastics as coatings, adhesives, linings, gaskets, etc.," said Mr. Huscher, "the use of corrosion-resistant all-plastics piping and tubing and of all-plastics chemical processing equipment is a recent development which is finding rapid acceptance in the field of technical corrosion protection. . . . The constant growth of the chemical industry increases the problems of corrosion and through discriminate and proper applications of plastics, these materials are becoming extremely valuable tools in the constant fight against corrosion."

Corrosion is largely an industrial problem, but even the housewife is coming to appreciate the fact that the molded plastics cabinet of her new room air conditioner does not rust or corrode, and that in her refrigerator plastics parts are equally free from that annoyance. Woven plastics window screen means to her an end to replacement of corroded metal mesh. The list of plastics anti-corrosion applications in an average household would fill a book and would embrace every kind of plastic made. Plastics are man's prime defense against corrosion.

Pipe, Tubing, and Fittings

Corrosion resistance has been a primary factor in the rapidly growing use of plastics pipe. (See also "Progress Report on Plastics Pipes," MODERN PLASTICS, May 1952.) Several types of pipe are involved, and the range of uses is increasing rapidly, involving both domestic and industrial installations.

Case histories of the anti-corrosion effectiveness of all kinds of plastics pipes are legion. Cellulose acetate butyrate, styrene alloys and copolymers, polyvinyl chloride, polyethylene, saran, glass reinforced polyesters, epoxies, nylon, and the fluorocarbons have all been made into pipe and fittings.

And each plastics material serves a special field in pipe. The corrosion problems in an oil well where salt water combines with sulfuric acid to attack steel pipe is quite different from that in a fuel gas distributing system where wet soil alkalies are encountered, and both are different from those in a chemical plant operating at high temperatures.

In a forthcoming issue of MODERN PLASTICS all available plastics pipe and fittings will be presented in chart form.

Not to appear in that chart, yet very important in corrosion control, are plastics joints used with metal pipe to block off any flow of electricity between pipe lengths and to couple pipes made of different metals.

Such couplings are made by Plastic Engineering and Sales Corp., Fort Worth, Texas, especially for the fuel gas industry. The Pesco ring joint gasket is molded of fibrous glass in combination with special synthetic resins; the Pesco insulating couplings are molded of nylon.

The ring joint gaskets were evolved to meet the demand for a stronger, safer ring gasket which could endure rugged handling. This type of dielectric ring eliminates galvanic action and resultant current flow which might lead to corrosion. Molded to withstand compressive pressures in excess of 60,000 p.s.i. and internal pressures of over 15,000 p.s.i., the rings have a moisture absorption of less than 1 percent. The nylon couplings will take pressures up to 1100 p.s.i. and temperatures up to 300° F.

Another unique corrosion-combatting material is saran-lined metal pipe, fittings, and valves. The unique

Courtesy Eastman Chemical Products, Inc.

Thick coating of cellulose acetate butyrate on the aluminum-tubing frame of lounge chair provides a surface which is rustfree in moist or salt air

method of manufacture results in an increased corrosion resistance factor of approximately 25%, as compared with unsupported saran, due to the fact that the material is under compression within the metallic sheath, densifying its physical structure. In producing saran lined pipe, an initially oversized pipe is cold swaged down to accurate pipe size diameter. Prior to swaging, a saran liner is inserted in the steel tube and the swaging operation locks the liner within the tube so firmly that liner and tube expand and contract as a single unit.

Saran lined malleable iron union fittings, cast iron flanged fittings, and cast steel flanged fittings (for use in high pressure service, or in piping installations conveying products which are both corrosive and flammable) are supplied by Saran Lined Pipe Co., Ferndale, Mich. In the lining process, polished steel mandrels are accurately centered in the fittings, insuring uniform thickness of lining, and the saran material is injection molded at high pressure in the space between the inside of the fitting and the outside of the mandrel.

Still in the specialized pipe and fittings field we find new polyethylene products. In the manufacture of couplings used to insulate one section of pipe from another as a means of preventing corrosion, Dresser Mfg. Div., Dresser Industries, Bradford, Pa., includes insulating gaskets of polyethylene which extend under the follower rings and effectively insulate them from the pipe. In addition, the polyethylene gasket or skirt extends over the pipe end, preventing any possibility of current flow along the pipe. Dresser also employs a polyethylene gasket or skirt on a special insulating-reducing coupling, used for joining dissimilar metals and pipe of different diameters.

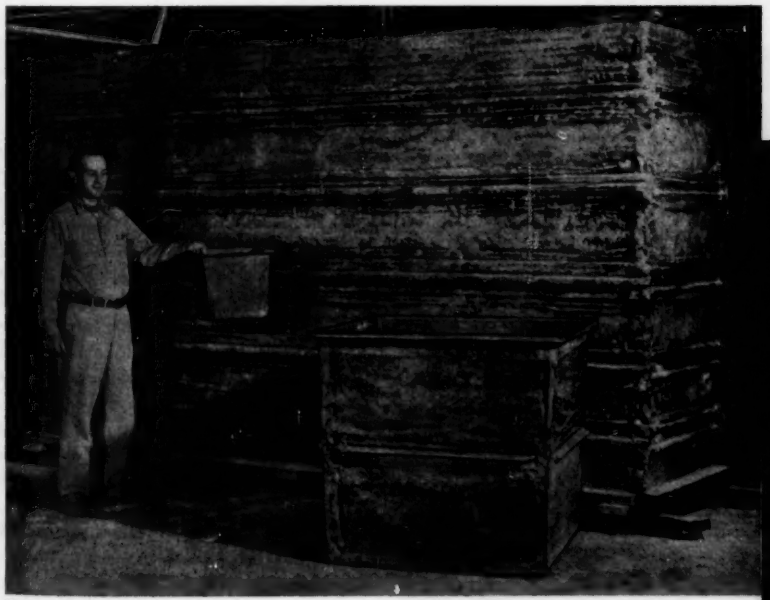
Not to be confused with plastics pipe, but used in corrosion control, are the Tygon vinyl tubing and gasketing made by U. S. Stoneware Co., Akron, Ohio, in six standard and many special formulations. For use with higher pressures, up to 300 p.s.i., the tubing is supplied with a braided jacket reinforcement of stainless steel, fabric, or suitable plastics material.

Tanks and Ducts

Numerous types of plastics materials are now being used in the production of tanks, duct work, and other kinds of chemical equipment in which a primary purpose is counteracting corrosion. Early examples of such equipment were often based on cast asbestos-filled phenolic resins, which could be used successfully with non-oxidizing acids but were attacked by alkalies. This problem has been overcome in part through the introduction of equipment composed of filled cast furfuryl alcohol resins.

Much of the recent development in this field has involved thermoplastic materials—notably methacrylate, polyethylene, saran, and polyvinyl chloride. Since these materials can be heat formed, they lend themselves to relatively simple fabrication methods and can thus be made into large and intricate structures if necessary. For equipment offering the maximum degree of

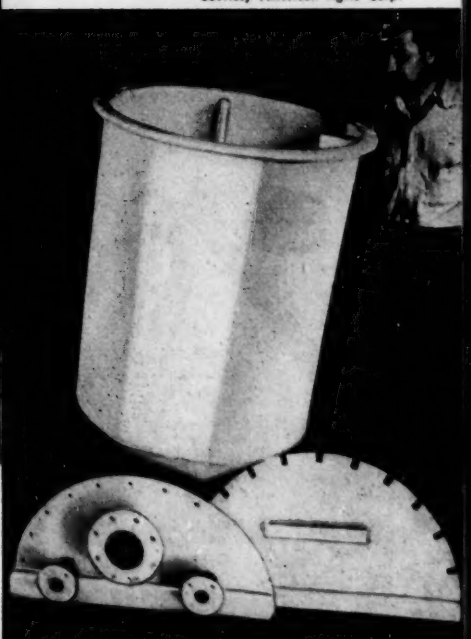
Cut-away section of joint shows installation of reinforced-plastics gaskets
Courtesy Plastic Engineering and Sales Corp.



Courtesy The Chemical Corp.

Tanks molded of fibrous glass reinforced polyester find wide applications in the electroplating industry because of their chemical resistance and insulating properties

Welded 40-gal. acid tank and cover are fabricated of unplasticized PVC
Courtesy American Agile Corp.

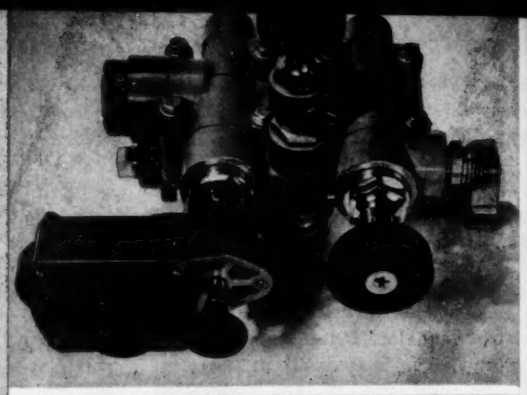


corrosion resistance throughout, even the nuts, bolts, or other types of fastenings with which the component parts are joined may be fabricated of the same type material.

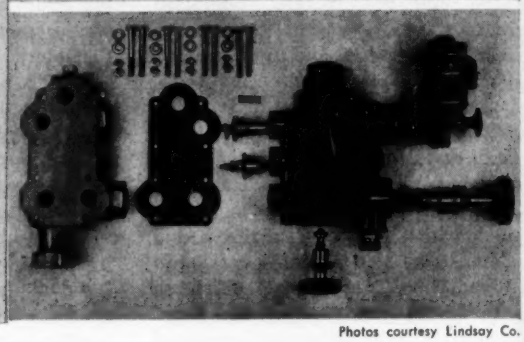
Paralleling the rapidly growing use of certain thermoplastic materials for structures of this kind is the increasing application of reinforced plastics for this purpose. Here again, the ease with which large or intricate structures may be fabricated, along with the inherent corrosion resistance of the materials, has contributed to the recent progress being made.

A number of companies in the U. S. are now working with unplasticized rigid polyvinyl chloride in fabricating corrosion-resistant equipment. Among the U. S. firms now producing corrosion-resistant equipment of this type material is The Atlas Mineral Products Co., Mertztown, Pa.

Formerly made of brass, automatic regeneration valve for water softener is now molded of Kralastic modified styrene



Exploded view of plastics valve. Unit, which is corrosion proof, weighs only one-third as much as its former metal counterpart



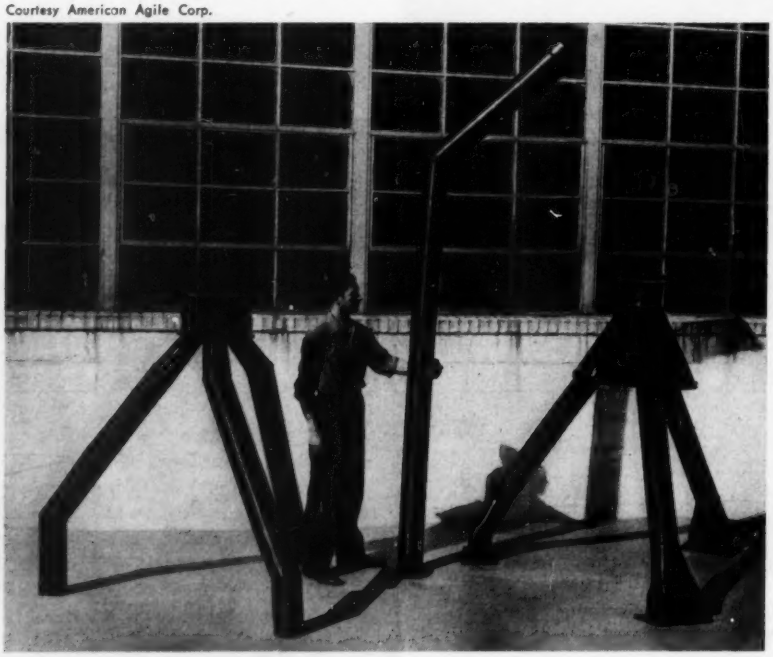
Photos courtesy Lindsay Co.

Welding Technique

Complete exhaust systems, dipping baskets, process equipment, tanks, and tank liners are among the products which Atlas makes of this material under the trade name of Ampcoflex. Available in the form of complete structures, sheet, or pipe, the material does not deteriorate or change over a wide range of normal operating temperature conditions. When the material is used for steel or concrete tank liners, a thermoplastic corrosion-resistant cushioning material is first applied to the tank to compensate for the thermal expansion differential. A hot gas welding technique is utilized by Atlas in fabrication.

Exhaust system manifolds used in collection and removal of corrosive vapors are fabricated of unplasticized polyvinyl chloride by means of hot gas welding

Courtesy American Agile Corp.



American Agile Corp., Cleveland, Ohio, fabricates corrosion-resistant equipment of unplasticized polyvinyl chloride under the trade name of Agilide. Typical applications of the material by this company include containers, tanks, and miscellaneous apparatus and equipment such as exhaust hoods and systems, reaction vessels, acids pumps, and valves. American Agile uses heat and pressure to form the material and also makes use of the hot gas welding technique. The Agilide equipment is limited in use to installations where operating temperature does not exceed 175° F.

Heil Process Equipment Corp., Cleveland, Ohio, includes rigid vinyl among the plastic materials used in its extensive line of corrosion-resistant equipment, using forming and welding operations to fabricate the material into rigid structural parts such as tanks, liners, ducts, and trays characterized by light weight and excellent chemical resistance.

American Lucoflex, Inc., New York, and Bolta Corp., Lawrence, Mass., are both major makers of rigid polyvinyl chloride sheet, rod, and tube material for fabrication into corrosion-resistant equipment.

Both American Agile and Heil also do considerable work with polyethylene in this field. Typical items produced by American Agile under

the Agilene trade name are fabricated bottles, jars and safety jugs, valves, piping and tubing, acid make-up tanks, fume ducts, tank liners, and electroplating barrels. Polyethylene is more resistant to corrosion than stainless steel and other high-priced metal alloys.

Polyethylene containers in a wide range of sizes and capacities are now used in handling corrosive chemicals such as hydrofluoric acid. Weighing only ⅓ as much as glass, these containers have the virtue of being non-breakable in normal service.

In producing a complete line of tanks, ducts, hoods, stacks, waste pipe, and related equipment for corrosion-resistant use in the metal finishing and chemical process industries, The Chemical Corp., Springfield, Mass., works primarily with polyester resins and glass fibers, although some of its equipment involves other types of resins and reinforcing agents. The resulting structures combine strength, light weight, and resilience with resistance to a wide variety of solutions and fumes. On the basis of more than two years of experience in hundreds of plating rooms, Chemical Corp.'s Pla-Tank equipment has proved its practicability for tanks, fume hoods, ducts, and drain pipe when used with various types of plating solutions used for brass, cadmium, copper, silver, zinc, etc.

Tanks for electroplating in the Pla-Tank line are molded as large as 48 by 36 by 48 inches. Because of the excellent dielectric properties of the polyester-glass fiber material, it is not necessary to insulate electrical connections from the tank rim.

77-Ft. Stack

A typical installation of Pla-Tank polyester-glass fiber equipment is a 77-ft. high fume vent stack at a nickel plating shop in Boston, supported by light metal brackets. A specially molded adapter leads out of the building, connecting to an assembly of standard size units, straight lengths and 45° elbows, with bolted flange shields. Stacks ranging up to 54 in. diameter and 60 ft. or more in height are not uncommon. Guy rings are permanently molded to the stacks and the use of plastics coated cables keeps the entire installation corrosion proof.

Photos Grinnell Co., Inc.

Kel-F diaphragm and rubber backing for valve applications

Cut-away view of a valve, with non-corroding diaphragm installed

The corrosion-resistant industrial equipment made by Haveg Corp., Newark, Del., is molded from a mixture of a special acid-digested asbestos in combination with phenol-formaldehyde or furfuryl-alcohol resins. It includes such items as pipe and fittings, valves, pumps, tanks, and fume duct systems.

Haveg equipment is produced by loading the mixed ingredients into molds and applying heat and pressure. The use of relatively light, inexpensive molds permits the production of large sized equipment molded in a single piece without joints or seams. Tanks can be produced in one unit as large as 10 ft. in diameter and 12 ft. in depth. Having a specific gravity about one-fifth that of steel, the material is unaffected by rapid temperature changes and can be used continuously at temperatures as high as 265° F.

Haveg also produces a line of special cements which are mixtures of the regular types of Haveg resins with suitable fillers, according to the type of service involved. These cements, used with an acid catalyst, are employed for grouting tanks, laying up linings next to iron, steel, concrete, etc., or joining sections of Haveg equipment.

Cold Cast

Excellent corrosion resistance is one of the outstanding features of a line of cold cast chemical equipment made by General Ceramics & Steatite Corp., Keasbey, N.J. The material, used in combination with an acid catalyst, is a new type of modified phenolic resin with an inert carbon filler, developed by Pennsylvania Salt Mfg. Co. Known as Chemplas, the material can be cast into dense, homogeneous structures with low water absorption and resistance to all acids except those which are highly oxidizing. Valves, centrifugal pumps, pipe and fittings, gas towers, and vessels are among the corrosion-resistant items which have been cast of this material. Light in weight, the castings are completely stable at temperatures up to 375° F.

Courtesy Eastman Chemical Products, Inc.

Water meter seal is molded of Tenite II cellulose acetate butyrate

Many corrosion-resistant plastics pumps, valves, and other items are widely used to handle "problem" products. For example, Grinnell Co., Inc., Providence, R.I., makes effective use of molded Kel-F, polyethylene, and Teflon in its line of Grinnell-Saunders diaphragm valves. These valves, originally designed to eliminate costly leakage and maintenance in compressed air lines, are now used in a widely di-

In this steel mill, a coating consisting of a copolymer of styrene and butadiene has been used extensively on the structural work and walls to shield them against corrosion

versified group of applications where corrosion, abrasion, contamination, and leakage constitute operating problems.

The type of material specified for the valve in each instance depends upon the nature of the installation and service conditions. Thus the Grinnell polyethylene diaphragms are used at temperatures from 10 above zero to 160° F., while the Kel-F diaphragms are furnished for use at temperatures from 32 to 250° F., and Teflon for temperatures from zero to 300° F. All are serviceable at pressures up to as high as 150 p.s.i.

The Kel-F valves are chemically inert to all acids and alkalies in all concentrations, with the exception of molten alkali metals. To provide the necessary softness and flexibility in the Kel-F valves, the diaphragms are plasticized 25% with a low molecular weight Kel-F which does not impair the corrosion resistance of the material. Since Kel-F itself, even in the plasticized state, is not resilient, a floating tube nut design is used which automatically compensates for any concentration of closing forces. In addition, a molded synthetic rubber backing cushion absorbs the closing shock. The same type floating stud attachment is used on all three types of molded plastic diaphragms to eliminate possible trouble arising from the application of direct mechanical force on the plastic facing.

Corrosion problems associated with water meter registers are eliminated with the new Fog-Tite meter seal, molded of cellulose acetate butyrate by Plastal Specialties Co., Seattle, Wash., for Fog-Tite Meter Seal Co. This clear transparent unit forms a corrosion-proof and practically unbreakable box which completely encloses the water meter register and change gears. Filled with a non-freezing, transparent fluid, the seal is said to eliminate the usual troubles of condensation on register glasses, dirty faces and numerals, and stuck or corroded registers.

Permanent freedom from corrosion is one of the features of a durable foot-valve for water pumps, also molded of butyrate. Produced by Nordstrom and Carlson Co., Kenoza Lake, N.Y., the valve is also shatterproof and impervious to most oils and greases. When properly installed, it remains leakproof even after months in the water.

Corrosion-resistant, furane-based mortar and cement are being successfully used in such applications as laying up acid brick sheathing for pickling tanks

Photos this page courtesy Nukem Products Corp.

Brass Replaced

The experience of the Lindsay Co., St. Paul, Minn., national manufacturers of automatic home water softeners, affords another excellent example of how plastics are being

used to fight corrosion in industrial equipment. The Lindsay application is an automatic regeneration valve which was formerly made of brass and is now molded of Kralastic modified styrene, with greatly improved results.

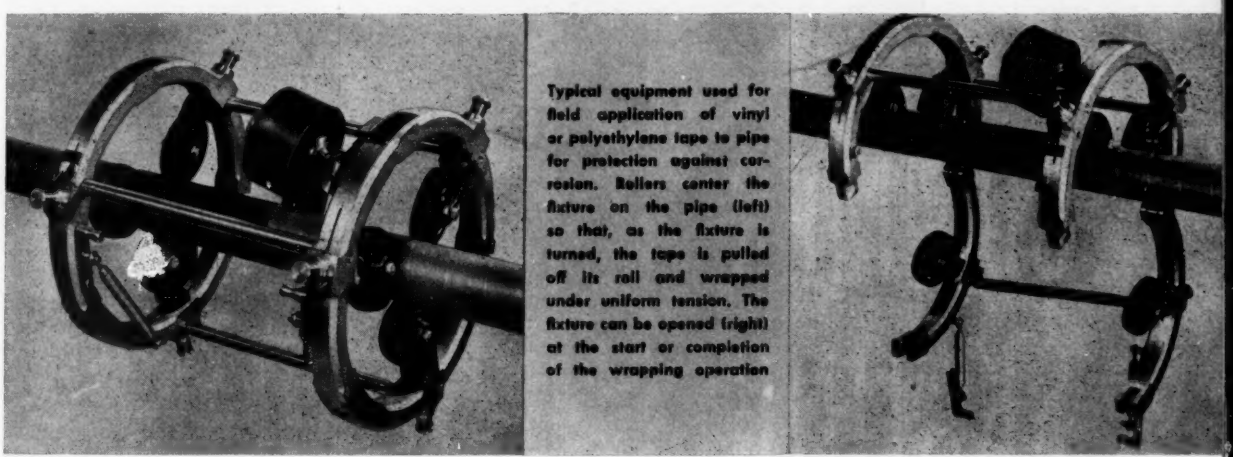
Prior to adaption of the new plastic valve, a non-corrosive water softener valve was unheard of, since these units must handle large quantities of corrosive minerals and salts. Weighing only one-third as much as the metal valve, the plastic valve has been tested to a pressure of 750 lb.—600 lb. more than the absolute maximum required for actual softening operation.

In the new valve, the first section, which connects valve and timer to the housepiping and tank, is made of malleable iron. The second part, containing all components necessary for automatic regeneration, is molded of Kralastic, actually consisting of three valves in one housing. These include a three-port, two-way valve which is manipulated to shut off the water during regeneration, a controlled secondary valve to time the regeneration cycle and return the softener to use, and a bake wash valve.

Crane Packing Co., Chicago, is among those companies which have done extensive work with Teflon in the production of packings and gaskets which fight corrosion. Teflon withstands practically all acid and alkali chemicals over a wide temperature range, being flexible at minus 94° F. and remarkably stable up to 620° F.

Crane's Chemlon line of packings are widely used throughout industry. They are manufactured in a variety of forms, including solid, tapered, and V molded rings, and in several braided styles. Gaskets are molded or cut in solid forms for smooth flange surfaces.

A new type filling machine recently developed by the Horix Mfg. Co., Corliss Station, Pittsburgh, Pa., and designed for handling sulfuric acid and other corrosive materials, makes extensive use of corrosion-resistant plastics parts. The filling valves, $1\frac{3}{16}$ in. in diameter, are of all-plastics construction and the conveyor on which the containers are transported is made up of molded nylon links. Bottle-lifter assemblies have plastics parts; bottle guides are of plastics, as are change parts, tank cover, and feed screw. The filling valves are actuated by the upward pressure of the containers against the valve seal as they are lifted.



Typical equipment used for field application of vinyl or polyethylene tape to pipe for protection against corrosion. Rollers center the fixture on the pipe (left) so that, as the fixture is turned, the tape is pulled off its roll and wrapped under uniform tension. The fixture can be opened (right) at the start or completion of the wrapping operation

Coatings and Linings

In the constant struggle against corrosion, plastics are not always used as cast or molded structures, or as extruded pipe or tubing. In many applications, adequate anti-corrosion protection can be obtained by using suitably selected plastics in the form of relatively thin coatings or somewhat thicker linings. And there are other installations where plastics tapes prove to be the ideal answer.

In recent years, the public has become increasingly familiar with clear acrylic sprays packed in self-dispensing type aerosol containers, which may be used to protect automotive bumpers, moldings, and other chrome plated metal parts against unsightly weathering and corrosion.

In the industrial field, the protection problem is usually quite technical in nature, calling for the use of selected coatings or linings specifically chosen for the job. Among the many types of plastics which figure most prominently in this phase of corrosion control are the vinyls, phenolics, silicones, saran, styrene-butadiene copolymers, furanes, epoxies, and polyethylene. While a complete review of their relative properties is beyond the scope of this article, the following cases will serve to illustrate their extensive industrial applications.

Nukem Products Corp., Buffalo, N.Y., includes in its diversified line of anti-corrosion equipment various types of vinyl copolymer and styrene-butadiene copolymer protective coatings and tank linings, as well as an all-purpose furane-based jointing compound immune to strong solutions of virtually all commercial acids, alkalies, salts, or solvents. Nukemite 24, 35, and 40 are acid and alkali resistant coatings having numerous applications where corrosive conditions prevail. No. 24, a copolymer of styrene and butadiene, was developed expressly for use as an easily applied corrosion-resistant paint. No. 35, a very viscous high-solids solution of vinyl co-polymer

(*Continued on p. 176*)

Polyethylene pipe to carry the refrigerant makes the popularization of take-up rinks for summer ice skating an economic practicality

SUMMER SKATING

at lower cost made possible through design of rinks using refrigeration lines of polyethylene pipes

SEVERAL years ago the Department of Parks and Recreation of the City of Detroit considered the construction of an outdoor artificial ice skating rink. Lowest cost estimate was $150,000 and metal pipe was in short supply. Hence the project was shelved.

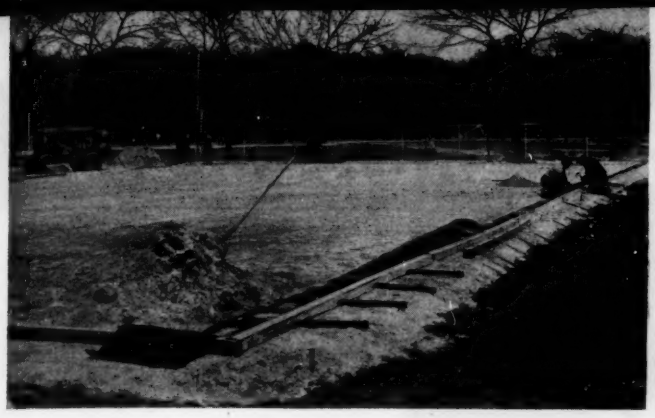
Since then, polyethylene pipe has come into the picture and on May 20, on an experimental ice rink set up on the tennis courts in Chandler Park, in 78° summer temperatures, children skated while others swam in a pool on the other side of the fence.

It all came about when A. G. Ghysels, president of Michigan Plastic Pipe Co., C. A. Meadows, an ice rink engineering specialist from Toronto, Wm. E. Bachman of the Department of Parks and Recreation of the City of Detroit, and Charles R. Beltz, of Beltz Refrigeration, collaborated on the design and construction of an ice rink made with plastics pipe. This experimental rink was 140 by 70 ft. and used 30,000 ft. of polyethylene pipe.

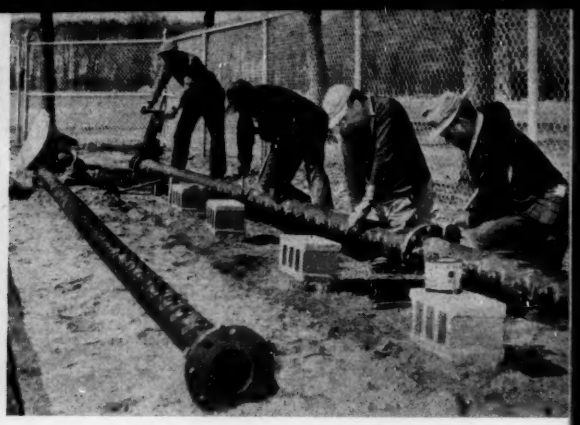
The polyethylene pipe, supplied by Michigan Plastic Pipe Co., had an inside diameter of 1.050 in. and a wall thickness of 0.093 inch. At the far end of the rink, away from the compressor, cast iron U's with female openings were used. Into these openings were screwed injection molded styrene copolymer male adapters. The pipe was attached to these adapters by the use of Breeze Aero-Seal QS-100 clamps which were provided with stainless steel bands. Connections to the header pipe at the end of the rink closest to the compressor were made with the same type male adapters and clamps.

The compressor for the first experimental rink was set up on a 31-ft. Fruehauf trailer.

After assembly, the piping installation was given a 60-lb. pressure test before injecting the solution. In normal operation, only 15 lb. of pressure is used with a 1.2 specific gravity concentration of calcium chloride leaving the chiller at a temperature



Construction begins on an ice skating rink with the laying of water retaining frame. Polyethylene pipe greatly reduces final cost of project



Cast iron header pipe at end of rink closest to the compressor is later boxed to provide seating space

of about 12° F. and returning at approximately 15° F.

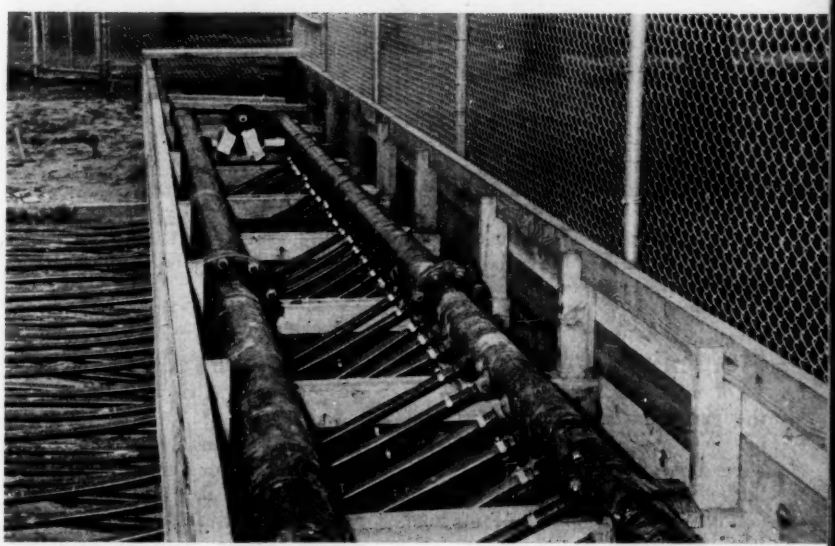
Furnished in 429-ft. coils, the polyethylene pipe was cut to lengths of 140 ft.—bringing an immediate saving in labor costs since steel or wrought iron pipe usually comes in 20-ft. lengths.

The Chandler Park rink is a take-up rink. It was not designed for permanent installation, and was removed from the courts after tests.

So successful was the experimental work that Versatile Ice Rinks, Inc., has been established to market a package ice rink. This will mean that a regulation hockey rink can be quickly installed on a tennis court, football field, or in a drive-in theater at a cost of between $50,000 and $70,000, depending on what is needed in the way of fences, lighting, etc. These prices are from $30,000 to $50,000 less than quotations on permanent ice rinks made in any other way.

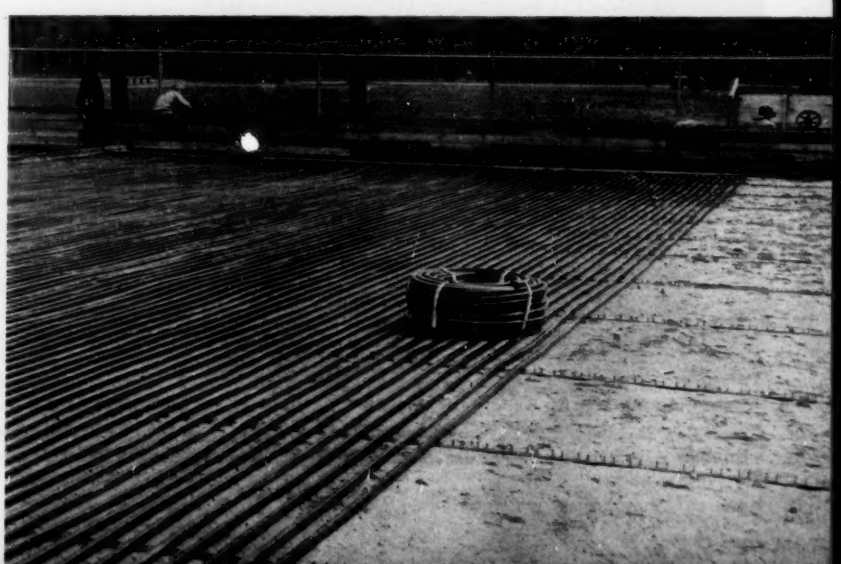
In the case of a take-up rink, the lengths of polyethylene pipe are simply lifted and placed in a wooden or cement block box which is installed alongside the area, the box serving as seats for skaters, tennis players, or spectators of other sports. The header pipe may also be boxed and that box used as additional seats.

At present the company is studying nylon for use in insert male adapters, a new type of plastic header pipe to replace steel, all-stainless steel clamps to replace those with only stainless bands, and a new design of U bend which, in replacing the cast iron unit, will permit longer lengths of plastics pipe to be used in building a rink.



Polyethylene pipe is connected to header by styrene copolymer male adaptors and clamps. Same adaptors are used with cast iron U's at other end

Pipe is laid on 4-in. centers. It was installed in lengths of 140 ft., compared with the 20-ft. lengths in which steel or wrought iron pipe generally comes



THE PLASTICS ERA

Courtesy Consolidated Vultee Aircraft

Convair's "Sea Dart," the Navy's delta-wing water based fighter plane, uses numerous reinforced plastics parts that are subjected to great stress, high loads, a wide range of temperature variations, and frequent long exposure to sea water

ROUNDING out this presentation of nine papers on plastics as they are now used in aircraft and as they are likely to be used in supersonic planes, guided missiles, and rockets are the three important contributions offered in this final panel discussion.

Carl R. Lemons, plastics engineer, Douglas Aircraft Co., Inc., is moderator of this third section as he was of the first two.

• • •

A PROJECT involving a large potential use of fibrous glass laminate is that of flak and armor plate for combat aircraft. The theory of plastics armor plate, as explained by Leonard J. Costanza, Materials and Process Engineering, Douglas Aircraft Co., Inc., El Segundo, Calif., involves a low interlaminar bond strength property of a specially balanced fibrous glass laminate. Delamination or interlaminar bond failure is undesirable in structural components and demands careful balance between glass and resin content to prevent its occurence, but if properly used it is extremely effective in absorbing the shock of projectile impact.

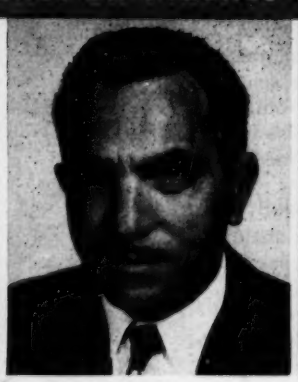
To complete the discussion on plastics in missiles applications, we come to the plastic adhesives which are currently used extensively in metal-to-metal and metal-to-honeycomb bonded assemblies. William E. Donaldson, associate head, Materials Engineering Div., Design and Production Dept., U. S. Naval Ordnance Test Station, deals with this application and also covers sealants and the requirements of casting resins used as potting compounds in protecting fragile instruments for rockets and missiles.

With the development of the new high-heat-resistant phenolic resins for use in making composite structures with asbestos, fibrous glass, and other reinforcements at relatively low pressures, the industry has stepped over a technical and

Members of the Third Panel on Plastics in Aircraft

THE MODERATOR
Carl R. Lemons
Douglas Aircraft Co., Inc.

AIRCRAFT ARMOR
Leonard J. Costanza
Douglas Aircraft Co., Inc.



BONDING AND POTTING
W. E. Donaldson
Naval Ordnance Test Station

COMPLETE STRUCTURES
Wm. E. Braham
Zenith Plastics Co.

IN AIRCRAFT

Part Three of a "Panel in Print"

design threshold toward a future in complete plastics aircraft structures. William E. Braham, chief engineer, Zenith Plastics Co., Gardena, Calif., contributes the article on that subject. While Mr. Braham's paper was not presented at the Las Vegas S. P. I. Conference, it was given at the eastern meeting of the Institute of Aeronautical Sciences held recently at Grumman Aircraft Engineering Corp., Bethpage, N. Y.

Plastics Armor for Aircraft

by Leonard J. Costanza

IN THE past several years a special interest has been shown in the protection of vital areas of aircraft from ground fire as well as from flak. On special missions, these aircraft have been equipped with armor plates made of 24S-T Dural and steel. These plates are fabricated to fit the contour of the particular areas to be protected and can be comparatively easily bolted onto the aircraft prior to the flight mission.

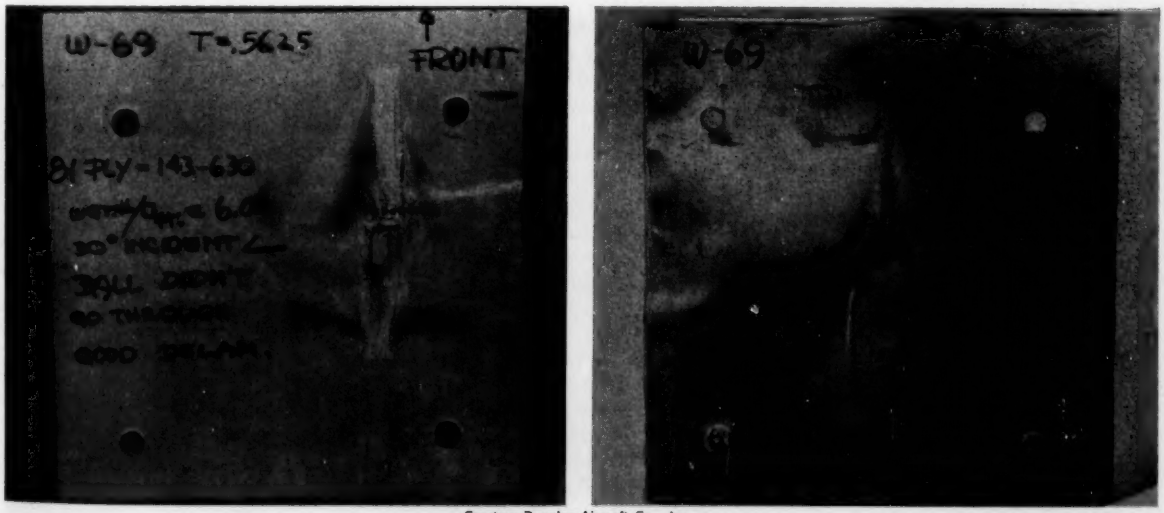
Because of the various problems involved with the fabrication, as well as weight and cost, of these metal armor plates, an investigation is in progress on the possible substitution of suitable plastics components for armor plate materials.

The use of reinforced plastics armor plate for aircraft poses some new and interesting problems in the field of reinforced plastics. We, as well as everyone else in the industry, have always been interested in good structural glass fabric and glass mat laminates with maximum physical properties. However, it is necessary to alter our whole viewpoint when considering the construction and types of materials to produce suitable reinforced plastics that will resist gun fire and shell fragments.

The basic principle of a good reinforced fibrous glass armor plate is a laminate that has exceptionally high stress distribution. Thus, such laminates would essentially have a low resin content with subsequent mechanical properties that are low in flexural and edgewise compressive strength and high in impact and tension.

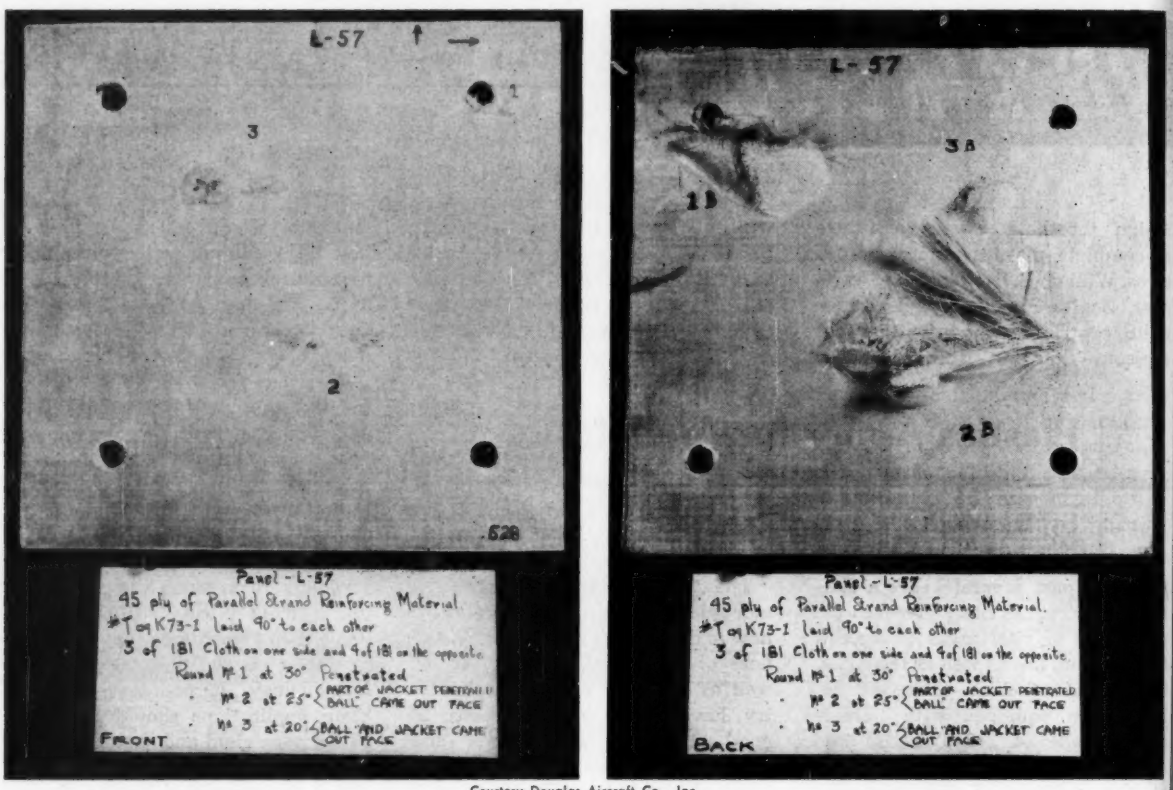
To reflect for a moment, consider the fact that sand will stop bullets and shell fragments because the impact is transmitted from grain to grain, giving the effect of the distribution of the force over wide areas. Therefore, it is safer to be near a bullet striking sand rather than one hitting a rock, since the shattering and jarring effect will cause less damage in a powdered material than in a solid mass of the same material. By analogy, laminates for armor plate applications should be tough rather than rigid and should embody the principle of stress distribution which is exemplified by the abovementioned action of sand.

The ballistic theory as evolved by General Electric to explain how and why Doron body armor stops a projectile is also applicable for reinforced plastics materials used as armor plates for aircraft protection. This theory "attributes the stopping power to high strength filaments and low strength binders — the latter



Courtesy Douglas Aircraft Co., Inc.

Armor panel of type 143 glass fabric reinforced plastics laminate after firing test. Results show good stress distribution; but because of the unidirectional construction of the 143 type weave, the panel tends to rip and shred in the air stream and is unsuitable for exterior armor



Courtesy Douglas Aircraft Co., Inc.

Armor plate test panel, using T09-K73-1 parallel strand reinforcing mat in laminate. Preliminary evaluation of test results indicates that reinforced plastics fibrous glass laminated armor plate is as effective as currently standard metal armor while effecting a major saving in weight

because it permits the fibers to break loose from each other and distribute stresses by slipping over one another, much as ductility in metals permits stress distribution by plastic flow.

Energy Absorber

The ballistic performance of a reinforced plastics laminate armor plate depends on its ability to delaminate — thus the low resin content and poor physical properties. The basic material of the laminate is, therefore, the energy absorber while the resin holds the filaments of that material in position to engage the projectile or shell fragments.

The questions of the best basic materials and of how to fabricate them into a suitable armor plate for aircraft protection are still unanswered.

Today, it is generally agreed that a number of glass fabrics and glass mats obtainable both in experimental and production lots hold at least partial answers to the problems. We are currently engaged in the evaluation of these materials in reinforced fibrous glass laminates.

In general, the basic materials being tested are glass fabrics — both with filament yarn and staple fiber yarn — and glass mats. In glass fabrics, the 143 type with the 225 and 450 yarn construction as well as the 150 yarn are being tested. One interesting fact noted is that the 143 type, because of its unidirectional construction, will not be suitable in a laminate for exterior use on aircraft because of its tendency to rip and shred in the air stream. Therefore, it will be necessary to have an exterior ply of a bi-directional type of glass fabric similar to the 181 weave.

Glass Finishes

An evaluation program on glass mats has been started, based on the comparatively new parallel or unidirectional mats, and the woven rovings. Some of these materials are the T09-K73-1 Parallel Strand Reinforcing Mat, manufactured by Owens-Corning Fiberglas Co.; the XC115, 2 oz., and XC118, 4 oz., woven rovings manufactured by Coast Manufacturing and Supply Co.; and numerous other woven rovings fabrics as supplied by Thalco.

It has been ascertained that a plain or starch finish on glass materials is desirable in plastics armor plate application. The treatment or non-treatment of these glass fabrics and mats serves as the interphase bond between the resin binder and the individual glass filaments.

As previously mentioned, the resins play a relatively minor role in reinforced plastics armor plate. However, the optimum resin content of the laminate is a prime consideration for this application. The resin content determines the balance to be maintained between ballistic and structural requirements. In general, it has been found that a resin content in the range of 18 to 25%, by weight, appears to give satisfactory results.

In the Douglas program for evaluating materials for use in plastics armor plate laminates, reinforced plastics plates, 12 in. square and ¼

to 5/8 in. thick have been prepared or procured using the aforementioned basic glass materials, with polyester resins as the binding agent. Lay-ups were made of the impregnated glass materials in the conventional cross-lamination procedure. The laid up panels were then cured under medium heat and pressure to maintain the desired low resin content. The panels were then prepared for the firing tests.

At present, no outstanding mili-

(*Continued on p.* 180)

Pottings and Adhesives in Rockets and Missiles

by W. E. Donaldson

THE U. S. Naval Ordnance Test Station has been interested in the use of plastics potting compounds and adhesives in rockets and guided missiles for the past several years. Potting compounds have been used not only for potting electronic units, but also in making models and temporary molds used in precision casting. One epoxy formulation is exceptionally well suited for casting high precision parts although it has not been used in production parts. Various polyester and phenolic materials have also been used for potting, although results have not been entirely satisfactory in most cases due to high stresses developed when the plastics are potted around metal.

The physical characteristics required of potting compounds vary considerably with different applications but in general we find that low thermal expansion, resistance to cracking when cast in heavy sections or around metal parts, and a minimum amount of heat generation on setting, have proved most valuable. Other desirable characteristics of perhaps lesser importance are ease of casting, low temperature casting, and transparency of the resin.

The use of adhesives in structural joints for rockets and guided missiles has many interesting applications but also introduces a number of serious problems. In many cases not only is a sound structural bond required but a pressure seal is also necessary that will take the expansion stresses encountered under temperature cycling.

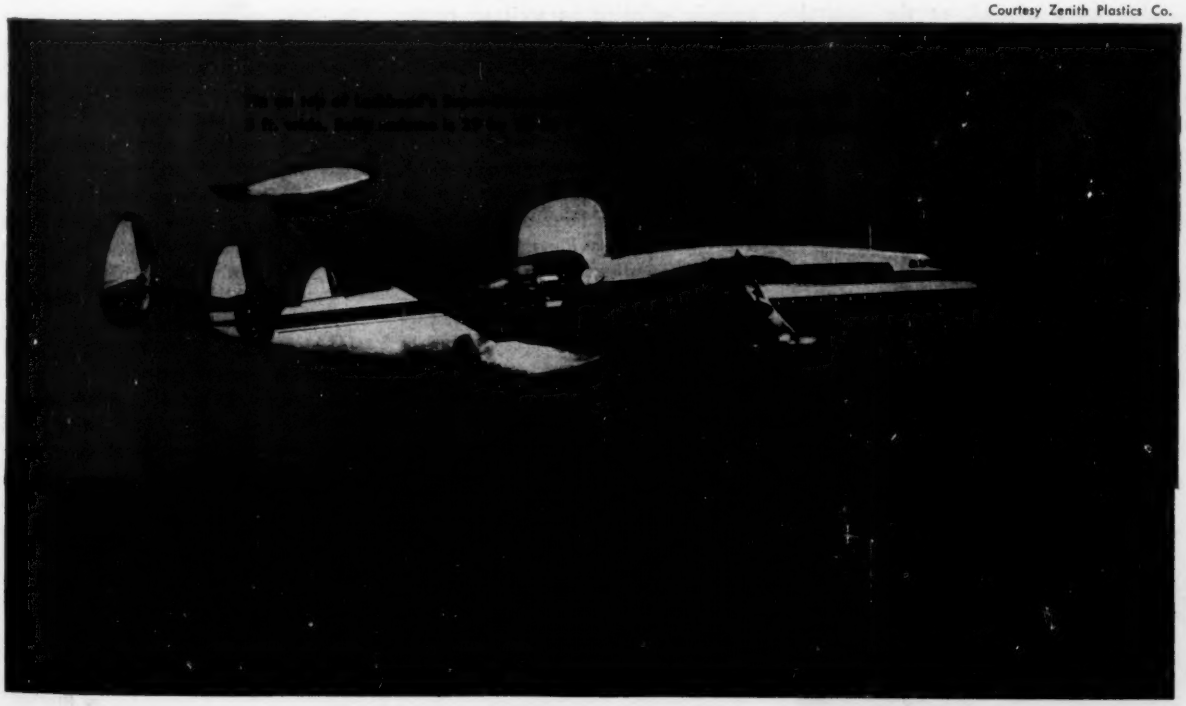
The majority of applications require metal-to-metal bonds such as anodized aluminum-to-cadmium plated steel, but other bonds also may be required. Glass reinforced polyester-to-glass reinforced cast phenolic, aluminum alloys-to-cast phenolic, cellulose acetate-to-aluminum alloys, cast aluminum-to-sheet aluminum, are some examples of the types of adhesive bonds that can be effectively used. Non-structural bonds, including many more types of materials and adhesive bonding for effecting a hermetic seal, are important parts of our joining program.

The major problem in "selling" a structural adhesive bond for use in ordnance components consists of devising some means of determining whether the bond is satisfactory. A non-destructive method is imperative. The adhesive cemented joint falls in the same category as soldering, brazing, and welding when considered from the standpoint of inspection.

Inspection Methods

The most feasible method of approach to the inspection problem for determining if an adhesive

Courtesy Zenith Plastics Co.



bonded joint is satisfactory appears to be a combination of statistical control and a method of determining whether the adhesive has completely filled the joined section. Possibly proof loading may become a reality as a nondestructive test method.

If we assume that we are cementing a cadmium plated steel plug into an anodized aluminum tube, the conditions are typical of the problems encountered. This joint must be temperature cycled at −65 to 165° F. and capable of withstanding an internal pressure of 3000 p.s.i. throughout the temperature range. As the aluminum has a greater thermal expansion than steel at the high temperatures, the aluminum tends to pull away from the steel plug, thus weakening the seal and causing it to leak. At low temperatures the reverse is true and a tighter joint is formed. This is advantageous unless the pressure is so great that it cracks the adhesive.

One inspection method under investigation is to make annular grooves in the tube and plug, force the adhesive into the grooves

(*Continued on p. 180*)

Reinforced Plastics In Complete Structures

by Wm. E. Braham

REQUIREMENTS for aircraft and guided missile structures are becoming more complex as time goes on. The advent of sonic and supersonic high altitude flight released a flood of design conditions that only a few short years ago were figments of the imagination of a few of our advance-thinking scientists. To further complicate structural design, electronic equipment has been developed that is now as necessary to high-speed aircraft as the control column was to airplanes of World War II.

The complexity of present day military aircraft and guided missiles is such that, according to a recent report by the Aircraft Industries Association, 27 times more engineering man hours are required today to handle the design of airplanes of comparable classes in production in 1945. This tremendous increase affects all other man power requirements similarly—more mechanics, inspectors, stenographers, auditors, etc., but the end product, when it leaves the ground, is an extremely efficient as well as costly machine.

This 27 to 1 ratio in the increase of engineering man hours covers all phases of engineering. Structural design, stress analysis, weight analysis, and testing man hours have all increased proportionately to account for the heat problems of high-speed flight and to provide multi-purpose structures—wings and fuselages that act as tanks, electronic insulators, armor plate, and pressurized compartments.

Aircraft and guided missiles operating at speeds greater than Mach 1.0 develop external surface temperatures in excess of several hundred degrees F. During World War II, the Germans recorded temperatures of 1500° F. on their V-2 missile. The effects of elevated temperatures on the metal alloys used in aircraft primary structures are well known and are recognized as detrimental to the efficiency and safety of the aircraft or guided missile. Improvements in these alloys are required, or new materials for primary structures must be developed.

The reinforced plastics industry, working closely with airframe manufacturers, recognized this condition and began the development of materials that would be suitable for primary aircraft and guided missiles, particularly those operating above the speed of sound. Numerous laboratory tests have been conducted in our own research laboratories and in the laboratories of some of the material suppliers.

A review of the resulting data reveals that the strength properties of aluminum and magnesium sheet alloys fall off rapidly above 300° F. Above that temperature, the most promising materials appear to be titanium, stainless steel, and fibrous glass phenolic laminate. In a sheet of equal weight, fibrous glass phenolic laminates compare favorably with metal alloy sheets on a stiffness basis, but the shear strength of the fibrous glass phenolic laminates is poorer than that of the metals. However, due to the inherent ease of constructing fibrous glass sandwich components, this characteristic can be overcome.

Over a period of ten years, which is almost the entire life of the reinforced plastics industry, many advantages have been found in the use of reinforced plastics materials for high performance aircraft and guided missiles. These materials are less expensive to mold and are more easily produced in tapered thickness for aircraft structures than metals. They are easier to service and maintain in the field, and resist the corrosive effects of exposure to air at high temperatures, sea water, high humidities, aircraft fuels, hydraulic fluids, and lubricating oils.

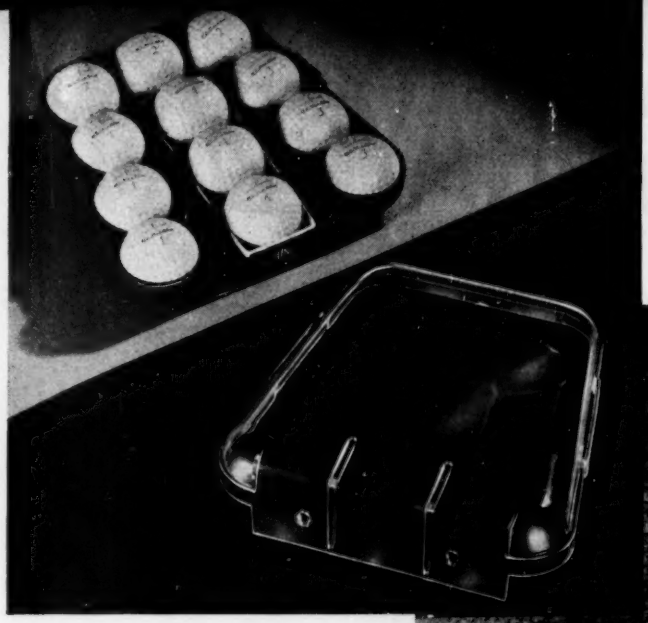
Tapered thicknesses which are required in most modern aircraft wing and tail surfaces can be produced from reinforced plastics materials with semi-skilled labor and inexpensive equipment. Molds and tools for forming the aircraft structures are less costly than equivalent tooling required to form metals. Less space and fewer complex assemblies are needed to produce a reinforced plastics structure, because component plastic parts can be easily bonded to their parent material under almost any atmospheric con-

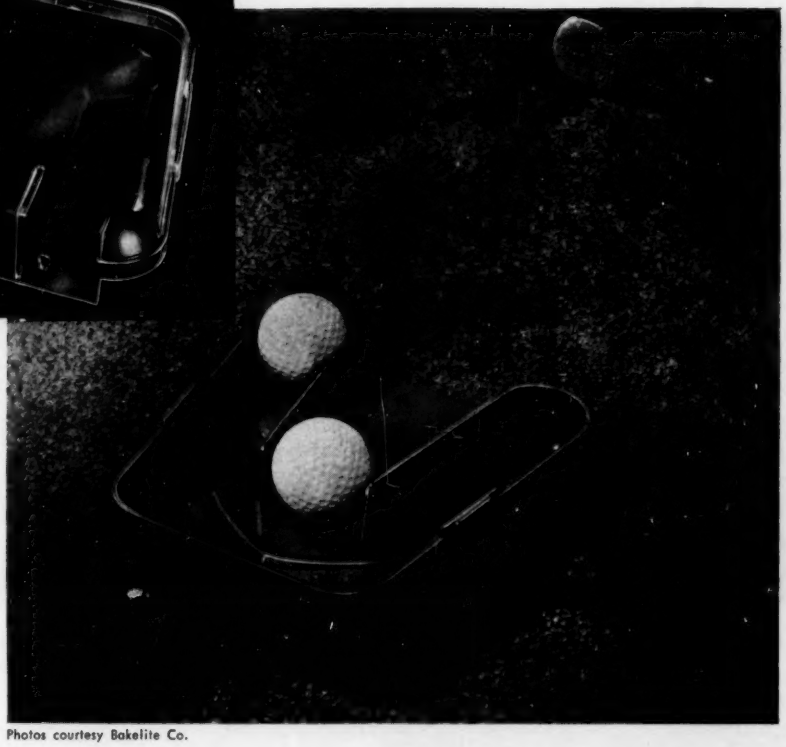
(*Continued on p. 182*)

Glass cloth reinforced plastics wing tip being assembled to a Thunderstreak jet fighter-bomber weighs only 4½ lb., can support 4800 lb. of pressure, and saves six important pounds of weight

Courtesy Republic Aviation Corp.

Sales Appeal for Golf Balls





Above: Display package for one dozen golf balls has molded styrene opaque base and transparent lid. Molded-in ribs in base give it re-use value as a practice putting cup (right)

Photos courtesy Bakelite Co.

TEEING off on the problem of packaging golf balls, plastics shoot a successful par for the course, scoring with two attractively and functionally designed sales-increasing display packages.

Both of the transparent, lightweight units—one formed from cellulose acetate supplied by Hercules Powder Co., the other molded of styrene supplied by Bakelite Co.—were designed to accommodate the brand of golf balls manufactured by U. S. Rubber Co.

The acetate package holds three of the balls by individually sealing them between two preformed half shells, each of which is vacuum formed by Robert Gair Co., Inc., New York, N. Y., as a series of three connecting hemispheres. To produce the three-pack, the balls are first loaded into the bottom half of the shell and the top half is fitted over them.

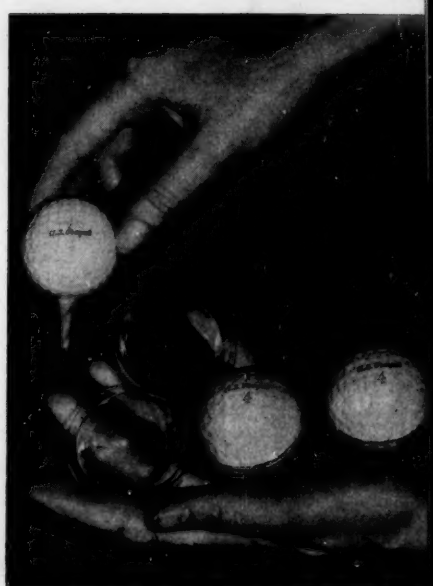
The entire assembly is finally fed into specially developed heat sealing equipment where the top and bottom halves are completely sealed together.

The individual spheres are joined to each other by a rigid fin. When the package is to be used, or in the event of a one-unit sale, a single sphere can be readily torn off from the others at this connecting strip without disturbing the seals on either side of the strip.

Since the semi-flexible acetate has been drawn down as thin as 0.004 in. during manufacture, each individual unit can be easily torn open, aided by a notch in the fin seal, and the ball removed.

The second package is molded of styrene by Cowan Boyden Corp., Chartley, Mass., in two parts—a transparent cover, which permits full product display on the sales counter, and an opaque green base. The base holds 12 golf balls, in rows of 4, and is so designed that it can be used as a cup for use in putting practice.

When the package is being used for this purpose, balls hit accurately through the opening formed by two molded-in partitions are guided by those separating walls to one side or the other, out of the path of subsequent balls.



Courtesy Hercules Powder Co.

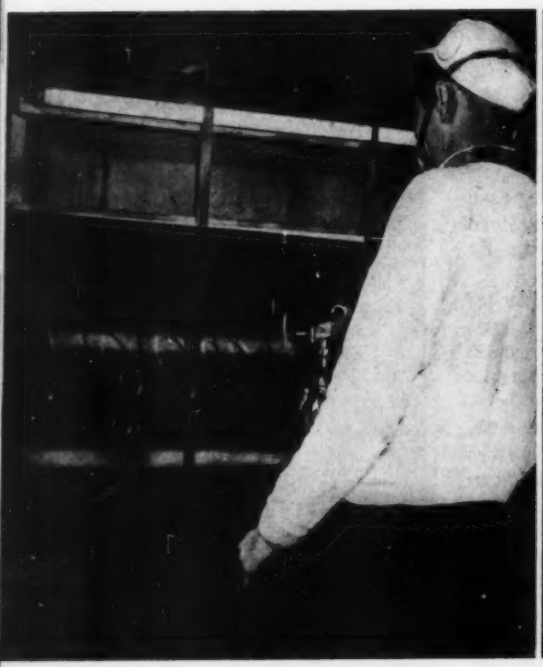
Formed acetate hemispheres are heat-sealed to produce connected packages

SPRAYED-ON

Photos courtesy Spraylat Corp.

Strippable vinyl coating, applied to reverse side of acrylic sign by spraying, air-dries into a transparent, elastic film that serves as a masking material

To prepare a sign which requires a colored background and clear letters, an outline is first scored through the film



After the film surrounding the scored letters has been stripped away, the sign is paint-sprayed

Film masking the letters is then stripped off the painted sign. Since finish is on reverse side of sign, a second color can be applied to the clear letters

MASKS

Film formed of vinyl emulsion can be easily cut and stripped; coating also serves to protect against abrasion

A STRIP-TYPE vinyl coating—sprayed on a surface in liquid form and air-dried to form an abrasion-resistant film covering—has been successfully adapted as a masking material for use in painting formed acrylic signs.

The coating, Spraylat A, was originally developed by the Spraylat Corp., New York, N.Y., as a means of protecting formed acrylic parts during fabrication, storage, and installation. Although this application —particularly in the case of large acrylic aircraft canopies—still absorbs the largest volume of Spraylat A, the coating is beginning to develop into a major industrial tool for the expanding field of acrylic display signs.

Since the popular appeal of many of these signs is based on attractive appearance and optical clarity, it is essential that a finished display be cleanly lettered and free from scratches. By using Spraylat A, both as a masking material and as a temporary protective coating, the possibilities of fuzzy lettering or accidental scratches are held to a minimum.

Using the Spray

The application of the coating to the signs—or to any other acrylic part—is a simple technique. After the sign has been formed, the liquid Spraylat A, which consists of an emulsion of polyvinyl butyraldehyde in water, is sprayed over the surface of the sign with a pressure-type air gun. When the solution has been applied to a thickness of 3 mils or more, it is allowed to dry into a transparent, elastic film that adheres firmly to the surface. Drying can be accomplished by leaving the coated sign at room temperatures for 12 hr.; drying time can be cut to 20 min. by using heat.

The outline of the letters to be painted are then carefully scored through the film on the reverse side of the sign. If the sign is three-dimensional and has raised lettering, the outline can easily be followed and scored with a knife. If the lettering is to be painted on a flat surface, a sheet of tracing paper, with the outline drawn upon it, is fastened to the underside of the sign. Since both sign and coating are transparent, the outline on the paper is simply duplicated in free-hand on the sign.

The scored area is then stripped off the sign by a steady pull away from the surface. The letters are now ready to be paint-sprayed while the rest of the sign is effectively masked against possible overspray. If the background is to be colored and the letters are to remain transparent, the procedure is simply reversed by stripping the film off the area surrounding the lettering.

When applying different colors, the letters which require one of the colors are scored, stripped, and painted. The process is repeated for each of the succeeding colors. Since the paint spraying is done on the reverse side of the sign, it is usually possible to spray colors on top of each other. However, where a second layer of color might show through the first, or where close work is necessary, Spraylat A can be re-applied in some cases directly over a painted area as an additional safeguard.

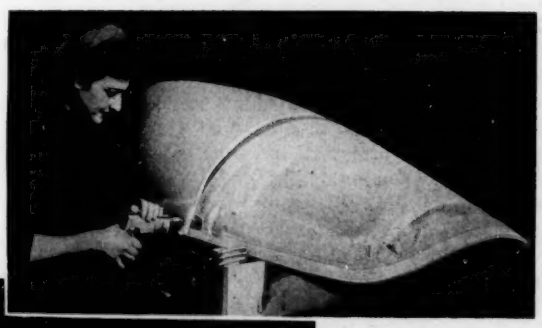
When the spraying is finished, the film can either be removed or left on the sign during shipment or any necessary subsequent machining operations. The film will protect the surface it covers during operations such as sanding, cutting, bending, drawing, and routing.

Other Applications

The success that the strippable film has had in the painting and protecting of formed acrylic signs has led to its adoption in a similar category by manufacturers of other acrylic parts, such as instrument panels.

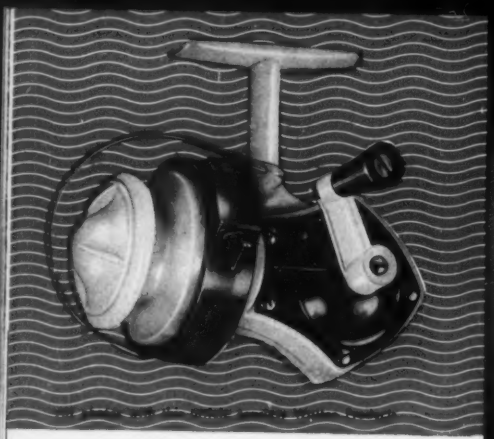
The coating can also be used on styrene surfaces in much the same manner and with much the same results. One manufacturer has already put this material to work in the decorating of a styrene evaporator door for a refrigerator.

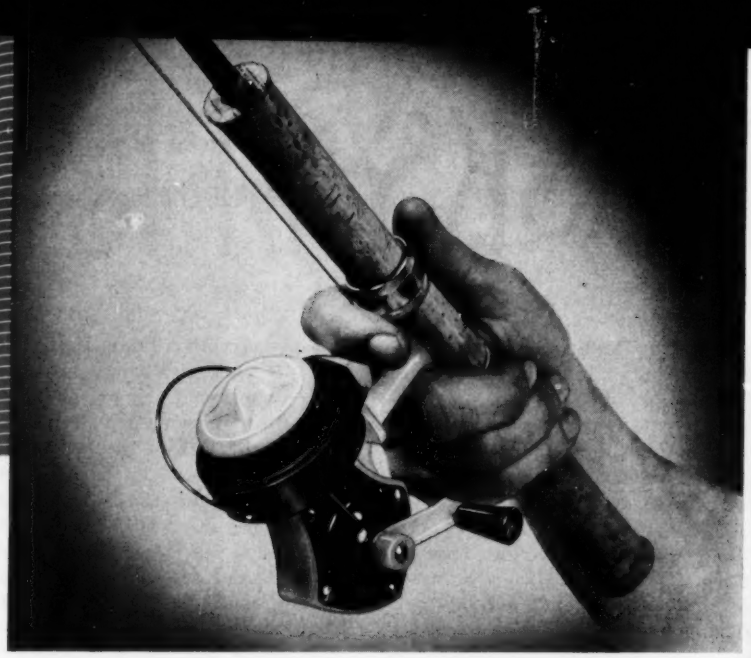
The dual usefulness of the Spraylat coating—as masking material and as surface protection—will undoubtedly suggest other applications in the production, finishing, and decorating of transparent plastics parts.



Tough vinyl coating protects both sides of an acrylic aircraft canopy while it is being drilled prior to installation

Abrasion-resistant film also serves as protection for canopy during other machining operations, such as routing





New spinning reel, shown above without line and at right as attached to a rod and ready for use, brings the advantages of molded nylon to an important sector of the sports field

Welcomed by Fishermen

Nylon spinning reel is light in weight, has long wearing parts, needs no lubrication

EMPHASIZING the growing use of plastics in the sports equipment field is a unique new spinning reel made up almost 100% of molded nylon parts. With the exception of a stainless steel shaft and line pick-up bale and assorted springs and assembly bolts, all components of the Waltco SR 100 Ny-o-lite reel, made by Waltco Products, Chicago, Ill., are injection molded of either green or natural color Du Pont nylon. Molding of the plastic parts—more than a dozen in all—is handled by Plano Molding Co., Plano, Ill., with final assembly of the reel by Waltco. Each reel is supplied with large and small interchangeable spools.

The Ny-o-lite reel marks the culmination of a project to produce a spinning reel combining light weight, extreme durability, smooth operation, and freedom from corrosion that would be a fitting companion for the quality line of solid and tubular fibrous glass spinning rods made by the Waltco organization. The reel has already been welcomed by seasoned fishermen as the ultimate in this type of equipment.

Just over 4 Ounces

The Ny-o-lite reel lives up to its name, tipping the scales at just a fraction more than 4 ounces. This is as much as 10 oz. less than conventional metal reels. As Waltco puts it, using the reel is "like fishing with a feather." Thanks to the self-lubricating properties of nylon, the reel requires no lubrication to protect it against wear, although, if desired, a drop of silicone lubricant may be used on the main shaft and gears for noiseless operation.

With the few metal parts made of stainless steel, the reel is completely immune to salt water, rust, and corrosion. Inasmuch as nylon makes one of the finest bearing surfaces known and because nylon gears show practically no signs of abrasive wear compared to metal gears, the reel will give many years of trouble-free service. Each reel is backed by Waltco with a five-year warranty covering replacement of any worn or broken parts.

Waltco believes that the Ny-o-lite reel marks a "first" as important in its field as was the introduction of the first fibrous glass-polyester fishing rods, which now have won a dominant position in the market. The toughness of the nylon material, plus its tensile strength of 13,000 p.s.i. and excellent dimensional stability in a temperature range of minus 70 to plus 375° F., make it an ideal material for this critical application, in which precision construction must be teamed with unusual durability. While advising owners that the reel is a piece of precision equipment that should be treated with respect, Waltco states that the reel will nevertheless take abuse which no other reel could withstand. It will not break, for example, even if dropped from a roof.

Multiple Parts

As indicated in the accompanying parts photograph, the Ny-o-lite reel comprises over a dozen individual molded parts of varying complexity.

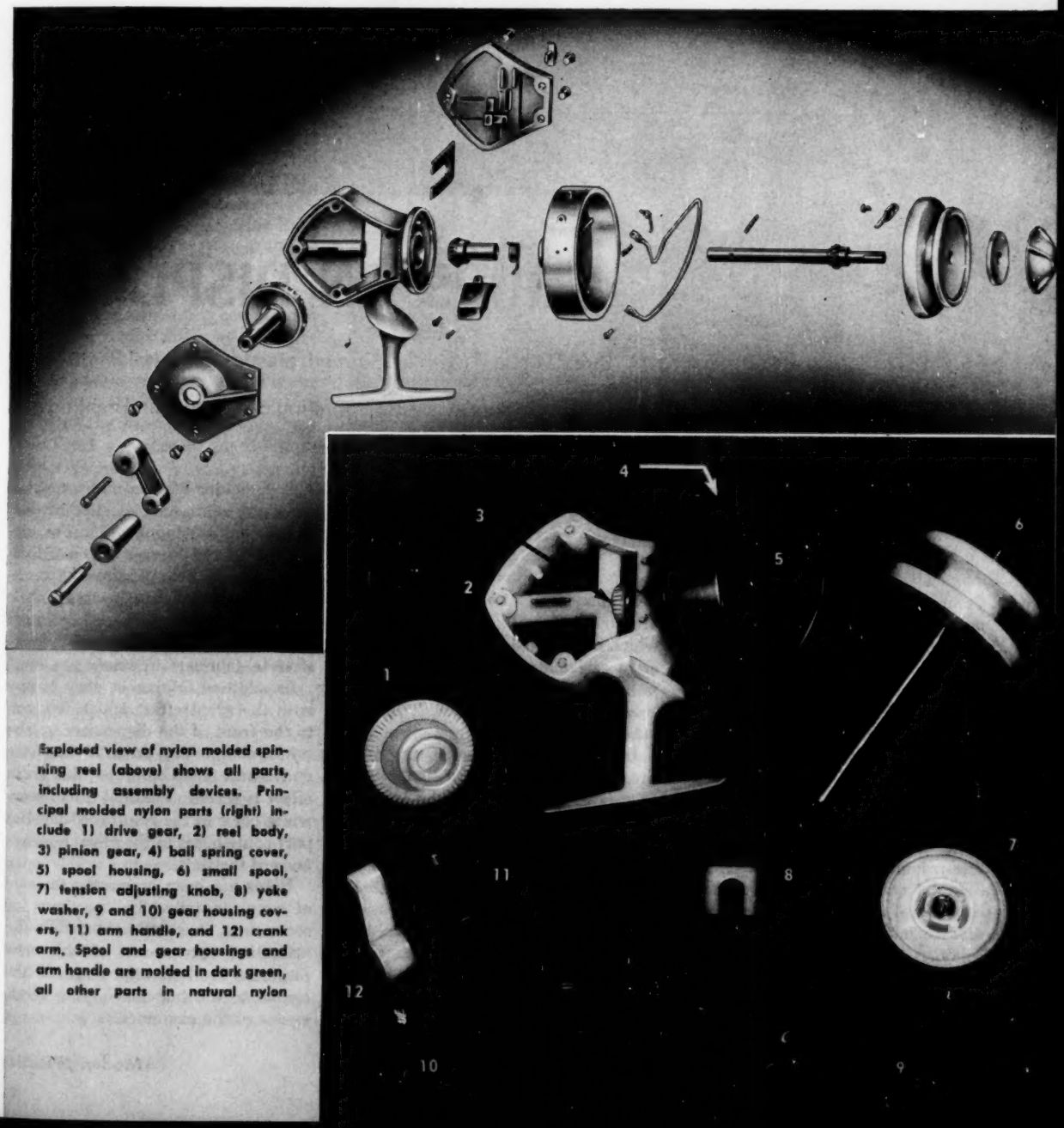
With the exception of the spool housing, gear housing covers, and arm handle, molded in an attractive dark green color, all other plastic parts are molded of natural nylon. These include the drive gear, crank arm, reel body, anti-reverse lever and button, yoke washer, pinion gear, bail spring cover, clicker

spring support, spools, tension adjusting plate, and tension adjusting knob.

Largest and most complex of the plastic parts is the reel body, which mounts the reel to the rod and also encloses the working parts. This piece has five blind cores in each side, around the outer edge, into which thread-cutting screws are driven to secure the gear housing covers in place. The piece is circular in front, with a projecting bearing surface against which the back of the spool housing turns smoothly. The rear section of this piece is molded with an integral central tube which supports the rear end of the steel shaft. A horizontal slot through the tube permits the metal drive pin on the shaft to engage the grooved eccentric integrally molded on the drive gear, causing the pinion gear and its shaft to reciprocate on the steel shaft. This action, which takes place when the crank handle is turned, produces a fore-and-aft movement of the rotating spool, causing the line to wind evenly.

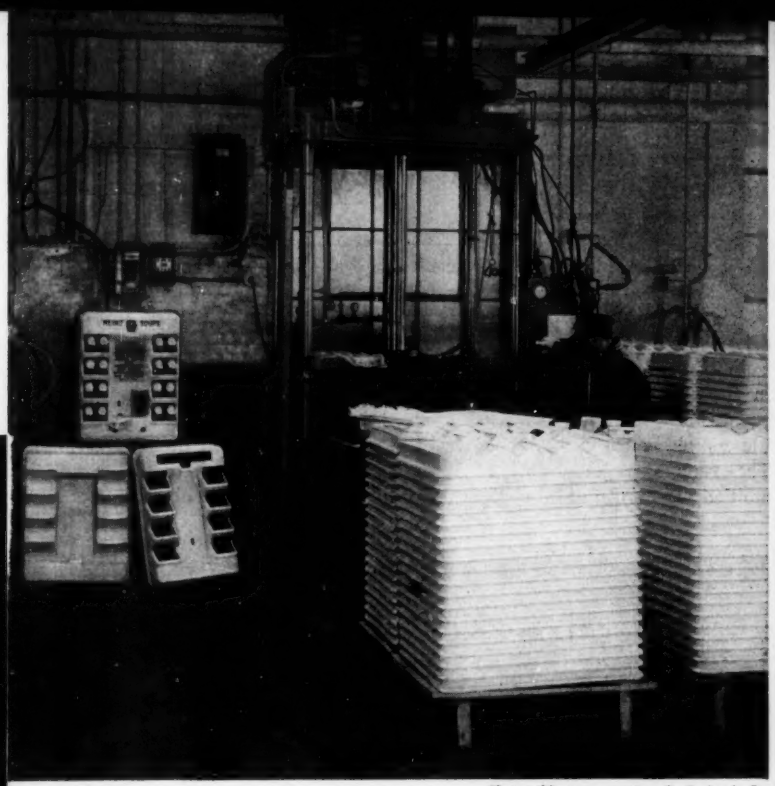
The three molded nylon gears involved include the ratchet gear, which mounts on the steel shaft, the drive gear, and the pinion gear, which it engages directly. To interchange spools, the tension adjusting knob, which is molded with a threaded female insert, is unscrewed from the front of the shaft and slipped off, along with the tension adjusting plate.

The anti-reverse lever, an L-shaped component, moves up and down in a vertical slot in the right gear housing cover, and is molded with a small opening through which the extension of the anti-reverse button passes after going through the cover plate. The button and the lever are cemented together at this point to form an integral assembly.



Exploded view of nylon molded spinning reel (above) shows all parts, including assembly devices. Principal molded nylon parts (right) include 1) drive gear, 2) reel body, 3) pinion gear, 4) ball spring cover, 5) spool housing, 6) small spool, 7) tension adjusting knob, 8) yoke washer, 9 and 10) gear housing covers, 11) arm handle, and 12) crank arm. Spool and gear housings and arm handle are molded in dark green, all other parts in natural nylon

Reinforced plastics face of "soup kitchen" is molded under 200 p.s.i. pressure and a die temperature of 255° F.



Openings in the plastics face of the soup display case are punched out after completion of molding operation

Photos this page courtesy G. B. Lewis Co.

SOUPS ON DISPLAY

Unit "kitchen" with reinforced plastics face holds 60 cans, speeds up serving by incorporating can opener and heating cup

A NEW and efficient "soup kitchen" for promoting the sale of prepared soups has recently been made available to drug stores, diners, and sandwich shops by J. H. Heinz Co.

Complete with a supply of canned soups, can opener, and heating cup, this unit makes it possible for an attendant to serve a portion of hot soup with a minimum of time and effort.

The front panel of the "kitchen" is molded of reinforced plastics, the section lettered "Heinz Soups" is a silk screened styrene insert, the menu is silk screened on a transparent sheet of Plexiglas, and the outer frame is red enameled steel. Displayed cans of soup rest in the ends of steel chutes, which can hold a total of 60 cans, with 16 cans on display.

The reinforced plastics face or front of the unit is molded without holes, the required openings being punched out in a subsequent production operation.

Preforms for the face are made up of chopped Fiberglas rovings and the part is molded in matched metal dies cast from Meehanite. The preform is impregnated with Selectron resin which is extended with Surfex, a calcium carbonate material. A molding pressure of 200 p.s.i. and a die temperature of 255° F. completes the cure in 150 seconds.

In the photograph showing the press in which the front panels are produced, a grouping at the left includes the panel as molded, the panel as punched, and a completed unit. The molder, G. B. Lewis Co., Plexton Div., Watertown, Wis., states that the punching or blanking operation is done with standard metal blanking tools and punch presses and that the operation proceeds at the same speed which would be used in blanking sheet steel.

The molder assigns many reasons for using reinforced plastics instead of steel for this application. For example, the tooling cost was less than half that which would have been required for steel. Furthermore, it is stated that the part as designed would have been practically impossible to fabricate in steel.

In addition, Heinz is very happy with the grain effect which is given to the front of the dispensers by the reinforced plastics part. Because the entire unit is back lighted, this grain effect is accentuated and the creamy white color of the reinforced plastics part contributes to the clean appearance of the unit.

Heinz has been promoting the sale of soups in individual portions for some time; it is anticipated that the attractive appearance of this new dispenser will greatly increase the appeal to the impulse-buying tendencies of the customer.

Where is Vinyl Acetate Heading?

Versatile material has a potentially brilliant but as yet unpredictable future

VINYL acetate is a most versatile plastic. Either monomer or polymer can be used in the production of adhesives; paint; concrete; soil conditioners; textile fibers; textile sizings and binders; permanent starches; chewing gum; and flashlight bulb coatings. Vinyl acetate reacts readily with many other chemicals to form such copolymers as vinyl chloride-acetate. It is the base material from which is produced polyvinyl butyral, polyvinyl alcohol, and polyvinyl formal, each of which is a highly desirable plastic used for well-established applications. Furthermore, at 15.5¢ a lb., it is one of the lowest cost monomers available.

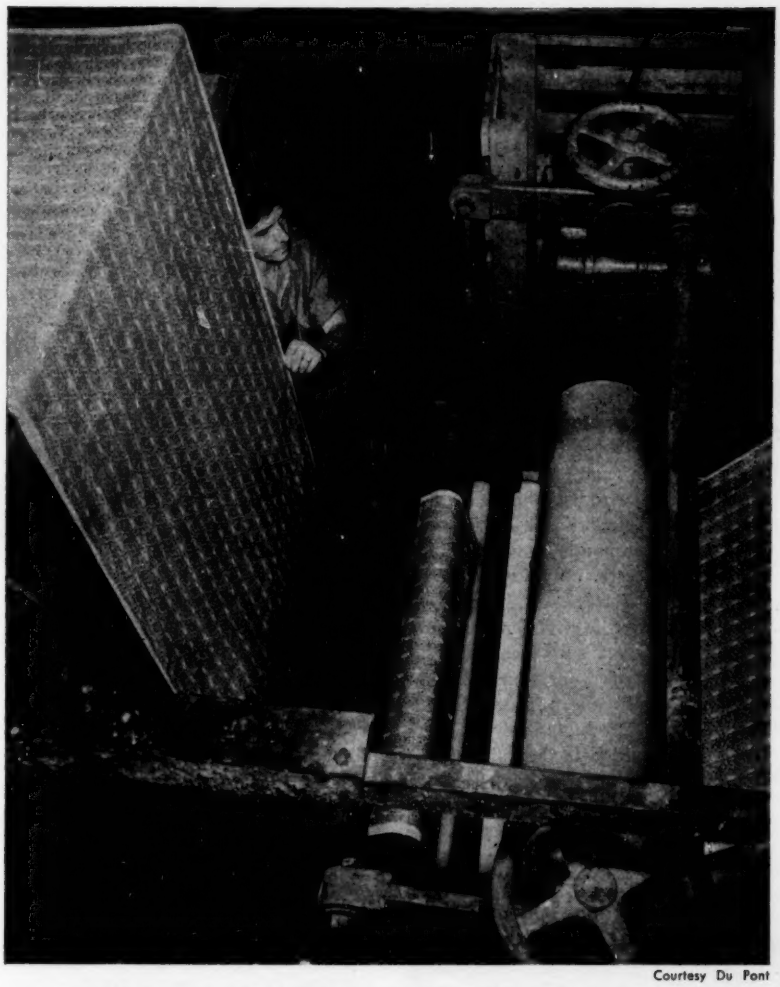
Yet like many other materials in the industry, it is the sort of product that makes chemical company officials pace the floor and bite their nails when trying to prognosticate its future.

Both the monomer and the polymer are threatened by competition from other resins that may be either less costly or have certain properties that are a bit more desirable for a specified end use. Furthermore, many of the proposed uses not yet in general acceptance require only tiny quantities of polyvinyl acetate per unit of use.

In 1951, there was a critical shortage of both monomer and polymer. It is now generally believed that the shortage was caused because a monomer producer was caught in the middle of a change-over between closing down an old uneconomical plant and starting a new plant which was not then quite ready for operation. Consequently, there was not enough monomer to meet normal needs plus the emergency requirement for polyvinyl acetate used in the manufacture of polyvinyl alcohol. The latter was in exorbitant demand because of its use in V-board for weatherproof boxes used by the military.

Enlarged Facilities

At that time, several producers and users of polyvinyl acetate were determined never to get caught short again and started plans to enlarge old facilities or build new ones. Their efforts, plus several announcements listing possible new uses for both monomer and polymer, created widespread questioning as to whether or not there was a need for additional monomer capacity.



Courtesy Du Pont

Polyvinyl acetate resin applied to cotton fabric gives great improvement in "hand" and imparts a finish which intensifies the brightness of textile colors

The total amount of vinyl acetate monomer produced in this country is never officially printed. It is difficult to offer a guess because the monomer is frequently just part of the process by which a company produces polyvinyl acetate, polyvinyl alcohol, or polyvinyl butyral and is seldom counted as a separate product. Guesses on the total amount of monomer produced run all the way from 75 to 95 million lb. a year. The guesses on polyvinyl acetate emulsion production place it at somewhere near 45 million pounds. The guess on polyvinyl alcohol generally runs from 12 to 14 million lb. and that would require just about twice as many pounds of monomer.

The general estimate on polyvinyl butyral is in the area between 15 and 20 million lb. and would require between 26 and 38 million lb. of acetate monomer. Polyvinyl acetal

and polyvinyl formal are produced only in moderate quantity.

Around 12 million lb. of vinyl acetate monomer was imported, almost entirely from Canada, in 1952. In December, however, this country was importing monomer at a rate of nearly 2 million lb. a month, while in the summer of 1952 the rate was less than ½ million lb. a month. The polymer importation in 1952 was about one million lb., nearly all of it from Italy.

Monomer Producers

There are as of this writing three monomer producers in the United States. They are Niacet, a Div. of Union Carbide, Celanese Chemical; and Du Pont. The latter company uses all of its own production. The imported monomer comes largely from Shawinigan Chemicals Ltd., Canada, and is shipped to Shawinigan Resins Corp. in Springfield, Mass., which company is owned jointly by Shawinigan Chemicals and Monsanto Chemical Co. In Springfield, the monomer is converted into polyvinyl acetate, polyvinyl alcohol, polyvinyl butyral, and polyvinyl formal. The textile division of Monsanto at Everett sells that portion of the resins used for textile treatment, but all others are sold by Shawinigan Products Corp., New York, N.Y., which is the sales agent for Shawinigan Resins Corp. Certificates of Necessity granted to Shawinigan Resins indicated that they expect to enlarge their facilities for the production of all the various resins produced from vinyl acetate monomer.

In addition to Shawinigan, the companies producing polyvinyl acetate polymer or emulsion are Du Pont, Bakelite, American Polymer, National Starch, Dewey & Almy, Colton, and American Waterproofing. Those producing polyvinyl alcohol are Du Pont, American Monomer Corp., Shawinigan, and Colton. Polyvinyl butyral resin producers are Bakelite, Du Pont, and Shawinigan. The latter company is the only producer of polyvinyl formal.

When a reporter for this magazine recently asked a producer of polyvinyl acetate for his opinion on the future of vinyl acetate and its derivatives, he replied: "Why don't you ask Celanese? If they are willing to risk the capital to construct a 30- or more million lb. capacity plant for vinyl acetate monomer, they must have confidence in its future growth."

The new Celanese Chemical plant at Pampa, Texas, came into production this summer. This operation has aroused more than usual interest because a new method that does not require acetylene is to be introduced. Spokesmen say the plant will produce monomer entirely from captive raw materials and the acetyl radical will be obtained directly from oxidation of butane and propane.

Paper milk bottles consume large quantities of vinyl acetate copolymer

Courtesy Bakelite Co.

Cost Doubtful

One reason for the curiosity aroused by this announcement is the possibility of a lower cost vinyl acetate monomer which can be produced without the use of acetylene. Present acetylene costs for large volume use are generally in the 13 to 16¢ per lb. range. Claims are made that a new process for making acetylene by oxidizing natural gas will be less costly—promoters say it may even be possible to go as low as 7 cents. On the other hand, old timers contend that the conventional carbide process for making acetylene will be as low in cost or lower than any other method in areas like the Tennessee Valley where electric power is very cheap. Power is the crucial item in carbide production.

Boosters for the Celanese project say that the vinyl acetate monomer process can compete with any process using acetylene at the lowest prices known today and regard the possibility of 7¢ acetylene from natural gas as doubtful.

In any case, it seems likely that the cost of vinyl acetate monomer may eventually decline below present levels, whether or not acetylene is used in the process.

Vinyl acetate monomer is today 15½¢ a pound. Polyvinyl acetate emulsions average from 19 to 24¢ a lb., but since they are about 55% solids in water the actual cost of the resin is close to 40 cents. Polyvinyl alcohol ranges from 72½¢ to 91¢ a lb. for most commonly used grades.

Vinyl monomer, when not used as a copolymer, is nearly always polymerized to polyvinyl acetate before it has much commercial value. Thus, polyvinyl alcohol is hydrolyzed polyvinyl acetate; 2 lb. of monomer is required to produce 1 lb. of alcohol. To obtain polyvinyl butyral, the alcohol is reacted with butyraldehyde. Polyvinyl acetal is obtained by reacting alcohol with acetaldehyde. Polyvinyl formal is procured by treating polyvinyl alcohol with formaldehyde.

Polyvinyl acetate is thus the key

Polyvinyl Acetate's Possibilities

A chart showing the present and 1957 estimated use for polyvinyl acetate was recently prepared by a leading chemical company that wishes to remain anonymous. Its findings are printed here to give an impression of how a reliable source feels about the future. The figures are given on a solid resin basis and do not include use as a chemical intermediate.

1952 — 40,000,000 lb. produced	
Used as follows	
Adhesives	**55%**
Textile and Paper	**25%**
Paint	**15%**
Miscellaneous	**5%**
1957 — Based on 100,000,000 lb. production, but with a belief that such a figure is ultra conservative	
Adhesives	**30%**
Textile and Paper	**10%**
Paint	**55%**
Miscellaneous	**5%**

to the future of vinyl acetate monomer volume. The polymer may be used as a dry resin but is more often sold in solution or emulsion form. It also has potentialities as a copolymer with a variety of different resins, but the future for that field is certainly not clear at this writing.

Present broad distribution of polyvinyl acetate may possibly be a forecast of future possibilities. One producer estimated that there may be 10 or 12 thousand customers for the polymer, but there are comparatively few who can use it in carload lots.

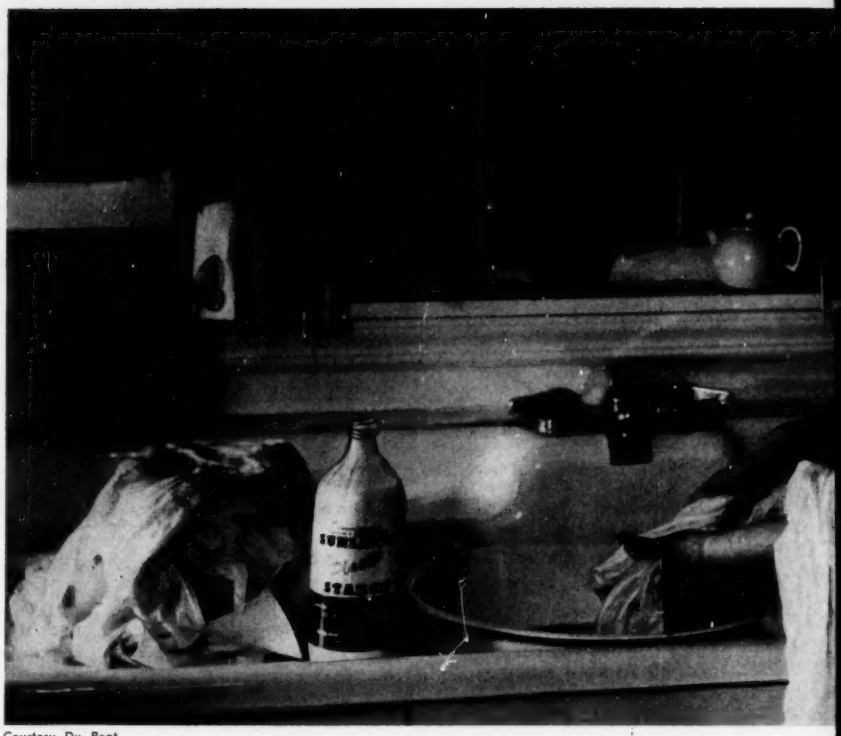
Versatility

The great versatility of polyvinyl acetate resin stems from the fact that the degree of polymerization is the principal factor governing variations in properties. For example, heat-sealing temperatures, water resistance, solution viscosities, tensile strengths, and flexibility increase as the degree of polymerization increases. The resin is colorless, odorless, tasteless, insoluble in water, but readily soluble in common organic solvents. It has excellent light stability and aging characteristics. The resin itself is non-toxic, but caution must be observed because some of the solvents used with it, such as methanol, are not.

Most commonly used plasticizers are dibutyl phthalate, phosphates, and sebacates. Two comparatively new polyester plasticizers, Hercoflex 900 and Resoflex 296, have recently won acclaim because of their non-volatility and non-migration properties. Plasticizers are used to increase flexibility, lower the softening and heat-sealing temperatures, and increase tackiness. If flexibility is not essential and a higher temperature softening point is desired, plasticizers are omitted.

The biggest portion of polyvinyl acetate is sold in emulsion form—that is, a 55% or more solids content in water with polyvinyl alcohol, or some other material used as an emulsifying agent. Water emulsions eliminate the need for expensive, flammable, and, in some cases, toxic solvents required for the solid resin. They eliminate the need for high cost solvent recovery systems.

By far the most widely known use of PVAC is in adhesive compounds where it has superior properties of tenacity. However, that phase of PVAC history will be postponed until later in this article where it can be combined with PVA (polyvinyl alcohol), also an important contributor to the adhesive revolution.



Courtesy Du Pont

Based on polyvinyl acetate, semi-permanent starches for domestic use have been well received by housewives, even though production is still in an early stage

Prospective Uses

Most sensational of the prospective uses for PVAC emulsion in the future is in paint for both interior and exterior uses. PVAC emulsion paint is similar in type to the so-called water or rubber-based paints, which means that it requires no oil or turpentine and can be applied by spray, brush, or roller. It has been widely used in Germany and England for 10 or 12 years in outdoor as well as indoor application even though linseed oil paints are now available in Europe at a lower cost than the vinyl paint.

A PVAC producer in this country has various exhibits scattered around the exterior of his premises which look just as good as or better than other paint jobs after several years of exposure. He points out that much progress has been made in improved formulations and that today's PVAC paint is far superior to the types of 8 or 10 years ago.

Critics have spread tales that PVAC emulsion paint is water sensitive, but producers claim it can be formulated to minimize that property; in fact, a small amount of water sensitivity is desirable so that the paint will wash a bit and not become flaky or peel off.

In the United States, the development of PVAC paints has been slow because of various conflicting factors. For example, styrene-butadiene emulsion paints have stolen the spotlight for interior work. The cost of styrene-butadiene resin is 32¢ a lb. compared to the PVAC emulsion type used for paint at between 36 and 43 cents. Other possible resin-type paints include improved vinyl chloride resins which are more definitely a possibility in this market than they were two or three years ago and they won't be limited to interior use. New acrylic-based emulsions for paints have already been announced and they have rather remarkable properties that cannot be overlooked either. It seems that almost every synthetic resin known is vying for recognition in the paint field.

However, criticisms of PVAC and

(*Continued on* p. 185)

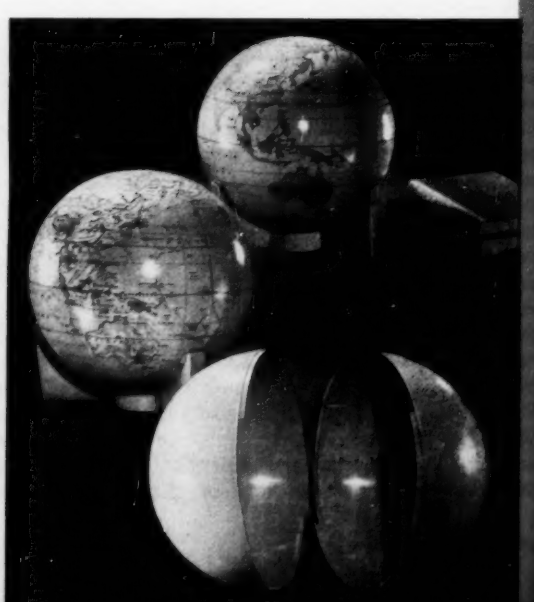
Sectioned tray, especially designed to fit kitchen drawers and large enough to take care of over-sized kitchen gadgets, is molded in bright colors of polyethylene. Pancake turners, spatulas, egg beaters, and similarly odd-shaped kitchen tools can be easily stored in any of the five compartments of the 12 by 15¾-in. tray. The flexible unit will not break or shatter, is odorless, noiseless, and can be washed in warm soapy water. The Gadgetray is molded by The Plas-Tex Corp., 2525 Military Ave., Los Angeles, Calif.

Fashionable, colored button beads, molded of Celanese acetate, are attached by a special lamination process to the three matching pieces of an ensemble consisting of handbag, belt, and hat. The glossy beads are easy to keep clean by just wiping with a damp cloth. The set is made by Lumured Plastics Corp., 347 5 Ave., New York, N. Y.

PLASTICS

Lemon squeezer, molded of hard vinyl in the shape of a fish, is as decorative an addition to the table setting as it is a practical accessory to use. By pressing the tail of the fish, the juice of a lemon wedge fitted into a well beneath the tail is squeezed out through the spout-like mouth. Spikes molded-into the bottom of the tail facilitate removal of the wedge. The taste-free, citric acid-resistant unit is made by Squeezit Corp., W. 177 St. and Harlem River, Morris Heights, N. Y.

Lightweight world globes, molded of Tenite II cellulose acetate butyrate and resting upon a butyrate base, can be easily handled by students during geography lessons without fear of breakage. A paper map is cemented to the surface of each globe and coated with lacquer. Elmer E. Mills Corp., 2930 N. Ashland Ave., Chicago, molds the world globes for Rand McNally & Co., P. O. Box 7600, Chicago, Ill.



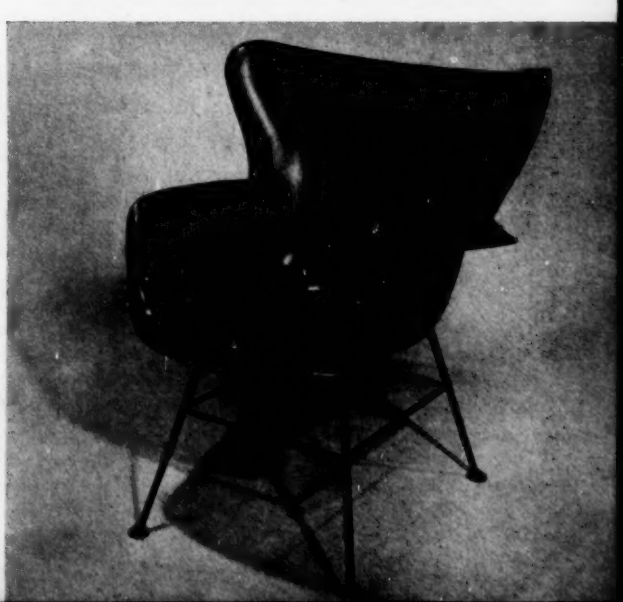
Designed for the busy office or kitchen, an all plastic accessory offers storage facilities for several different supplies. The entire unit, including a catch-all drawer and three deep wells for accommodating pencils, clips, a roll of paper, and a roll of Scotch tape, is molded of Monsanto's styrene. A perpetual calender, made of press polished vinyl, fits into a slot at the top of the unit. Made by Chatham Mfg. Co., Inc., Chatham, N. Y.

Housing of a spring driven timing device for use in kitchen, laboratory, or wherever accurate timing is needed, is molded of Plaskon urea in a wide range of colors. The tough, burn-resistant timer, which measures one min. intervals up to 60 min., signals an elapsed time setting by ringing a bell. The device is molded by Plastic Masters, New Buffalo, Mich. for distribution by Sears, Roebuck and Co., Chicago, Ill.

PRODUCTS

Remote-control tractor, molded of Tenite II cellulose acetate butyrate and equipped with rubber treads which cannot harm floor or furniture, is an authentic 1/16-in. scale model. By operating levers on the control box, the rugged toy can perform a variety of maneuvers including turning, climbing, pushing, backing up, or bulldozing. The Turn Trac is produced by Product Miniature Co., Inc., 2240 S. 54 St., Milwaukee, Wis.

Handsome styling, designed to blend equally as well with modern or traditional decor, characterizes a new barrel-wing, flat-armed chair with a reinforced plastic seat. Molded in one piece of resin-impregnated Fiberglas, the colorful seat combines light weight with exceptional strength and resistance to scratching, cracking, or other damage. Base frame and legs are tubular steel. Made by Selig Mfg. Co., Inc., Leominster. Mass.



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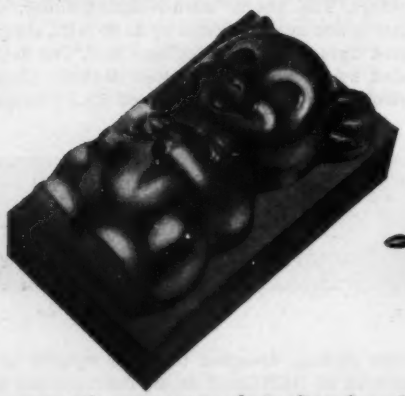

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Forming Steel with Plastics Dies

Draw dies of reinforced plastics are being used to turn out cold rolled and stainless steel parts by the thousands

Tailored lengths of resin impregnated fibrous glass rovings being laid up on pattern in mold box to form face of draw die

PLASTICS have been used for years in the production of forming or drawing dies for fabrication of light metals such as aluminum. They have been highly successful in this work. But the forming of cold rolled and stainless steel sheet is quite another matter. Here the die requirements for long runs call for materials that can take terrific punishment for extended periods of time. The fact that such plastics dies have now been developed marks another milestone in the contributions which plastics are making to allied industries.

It was some four years ago that Briggs Mfg. Co., Detroit, Mich., started experimenting with plastics resins and reinforcements in a development program on metal forming dies. In 1951 the company was awarded a large contract for the manufacture of aircraft sub-assemblies requiring many formed sheet aluminum parts. By this time, work had reached the point where the feasibility of using reinforced plastics dies for aluminum forming had been proved.

But this was only the beginning. Briggs was aiming at the forming of steel with plastics dies, and their accumulated know-how continued to be enriched with the experience gained in forming aluminum aircraft components. As a result, experimental work was continued on the use of these dies for forming automobile body components from steel.

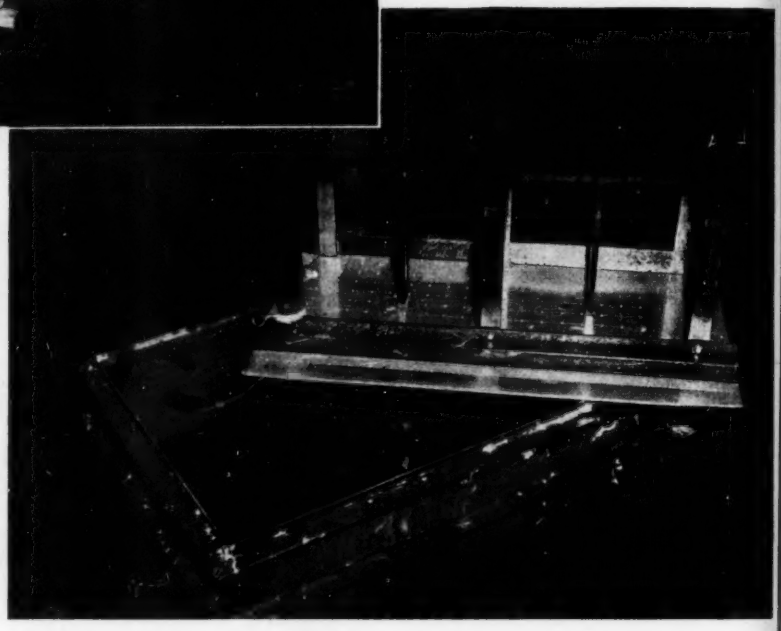
Because a steel die maker was late in delivering a set of five dies for Plymouth and Dodge underbody brackets, the plastics division of Briggs was given an opportunity to prove that its dies could not only form these parts from cold rolled steel ranging in thickness from 0.030 to 0.050 in., but also that it could get such dies into production rapidly. Speed was required because the lack of these automotive components was holding up the Plymouth and Dodge assembly lines. The design of these five dies required a total of 20 plastics working details. The dies were engineered, molded, finished, and tried out—the latter operation required running 360 trial stampings—in a total elapsed time of only 250 man-hours.

Long Life

The use of these plastics dies for this particular job was admittedly a stop-gap. No one knew how many stampings could be made before the plastics dies wore out. As a matter of fact, it was only necessary to run 700 stampings from each die before the steel dies were completed. The use of the plastics dies, however, was well justified if for no other

*Reg. U. S. Pat. Off.

Special set-up used in impregnating fibrous glass rovings. Rovings from bank of coils in background pass through tank, at end of which all the strands are combined to form one rope



Below: Impregnating box, with perforated lid, in which fibrous glass material and resin are placed under pressure to insure thorough impregnation

reason than that it permitted the assembly lines to start and keep running. The big surprise was that at the end of the run the plastics dies were in just as good a shape as they were at the beginning.

With this successful start, Briggs continued to build reinforced plastics dies for stamping steel. Certain dies have now run as high as 35,000 parts without appreciable signs of wear. Plastics draw dies now in experimental operation for automotive parts are producing outer and inner door panels, interior rear shelf panels, spare tire well covers, and exterior sun visors which extend across the complete width of the car body. These parts are being drawn from steel ranging in thickness from 0.035 to 0.060 inch. In experimental work, cold rolled steel as thick as 0.070 in. as well as 0.035-in. stainless steel have been drawn successfully.

Forming Techniques

All of these plastics forming dies are produced by a process developed at Briggs which combines the techniques of hand lay-up, casting, and molding. To date Owens Corning's Fiberglas, Pittsburgh Plate Glass' Selectron, and polyester resin supplied by Interchemical Corp. have been used exclusively, although development work with epoxy resins is now progressing. In all cases the die bodies consist of approximately 50% fibrous glass and 50% resin by weight.

The male models from which the dies are made may be in the form of metal stampings, plaster casts, wood, or clay. Whatever the model may be, it is first coated with a parting agent and then placed in a mold box. All dies are made up of two sections—the face and the body. The face has a thickness of ¼ to ⅜ in., and the body is as heavy as is required for suitable backing up and mounting. Two types of construction are used, depending on whether the die is to form aluminum or steel. Aluminum has a comparatively soft surface and is easily scratched; hence, dies for forming this metal have smooth faces made up of tailored lengths of fibrous glass rovings. Since steel has a much harder surface and since minute scratches on automotive parts do not detract from their utility, dies for this work are made with a fibrous glass cloth facing.

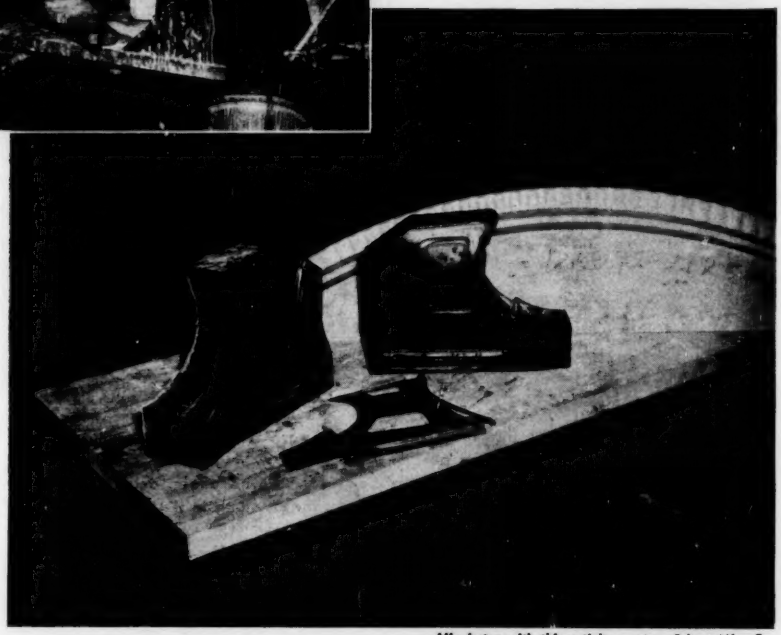
In producing dies for aluminum, multiple coils of fibrous glass rovings, usually 10, are set up on a rack in such a way that each roving may be fed through a special device developed at Briggs for separately impregnating each strand, combining all strands into one rope, and metering the amount of resin picked up. As the combined strands are drawn from the metering device in the impregnating tank they are cut to predetermined lengths and carefully laid up on the model until the required thickness has been reached.

Glass Cloth for Steel

If dies for steel are to be made, the face is made up of tailored layers of impregnated cloth instead of rovings, laid up on the model in the same manner. From this point

Loaded mold for producing a metal forming die is in press. Press is closed a predetermined distance and resin cure takes place under pressure

Male and female halves of a reinforced plastics metal forming die. A formed steel part is in foreground



All photos with this article courtesy Briggs Mfg. Co.

on, the production steps are the same whether the die is to be used for forming aluminum or steel. The polyester resin used is so catalyzed that no external heat is required for gel and cure.

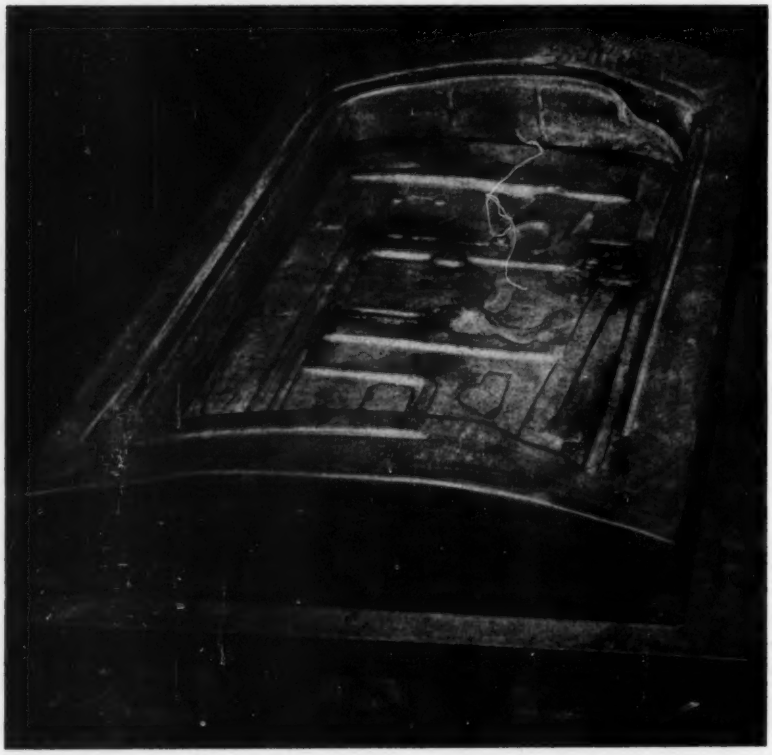
Two-inch lengths of chopped fibrous glass are placed in an impregnating box. The quantity of chopped glass is determined by the over-all volume of the die less the volume taken up by the face. After the required amount of glass is placed in the box, a quantity of resin, weighing approximately the same as the chopped strands, is poured on top of the strands. A perforated cover is then placed on top of the resin-glass mixture and the entire impregnating unit is placed in an air press, where from 10 to 20 p.s.i. are gradually applied, forcing the resin into the voids existing within the fibrous glass.

Pressure is maintained until resin issues from all the perforations in the top plate, indicating that thorough impregnation of the material has been achieved. The impregnation tank is then taken out of the press, the top plate taken off, and the mixture removed from the tank and loaded on top of the facing in the mold box. When all of the chopped strand has been loaded in the box, a top plate of soft pine, cut to fit the inside of the box, is placed on top of the mixture.

Die shoes then go on top of this plate and the entire set-up is loaded into an air operated press. In some cases, according to the

Draw die for stamping rear fender stone shields for automobiles has faces of resin-impregnated fibrous glass cloth. Material stamped is stainless steel

Complicated stamping in foreground above is an inner door panel for an automobile. It was stamped from cold rolled steel in a die and draw ring molded completely of reinforced plastics. The male half of the die, in background above, and the female half, in the photograph below, are shown ready for mounting in the stamping press



over-all height of the set-up, additional spacers may be required in order to make up the difference between the over-all height of the mold and the distance between the base and head of the press. Indicating marks on the side of the die shoes show the press operator when the "home depth" has been reached. In this manner, the over-all height of the plastics die is controlled to its predetermined dimension within close tolerances.

Cured Under Pressure

After the "home point" has been reached, using a closing pressure of somewhat over 20 p.s.i. of projected die area, the press is locked in that position and curing proceeds. Time for cure varies from 6 to 8 hr., according to the catalysts and activators in the resin. The polyester resin is catalyzed with D.D.M. and activated with cobalt. In all cases the resin is pigmented for identification purposes. Thus, all dies for drawing aluminum will be one color and dies for certain steel parts will be another.

Necessary gel time, determined by the amount of catalyst and activator added to the resin, is varied from job to job because certain dies take much longer for lay-up than others; the entire lay-up must be made and in the press before the gel stage is reached.

After curing has been completed, the plastics die is removed from the die box and placed in an oven for post baking or annealing, which takes approximately 72 hr. with an oven temperature ranging from 200 to 250° F.

Briggs has found that stamping dies made in this manner do not require that the original model be made slightly over-sized since there is no measurable after-shrinkage of the plastics part. It is stated that the reason no cold-mold-to-cold-piece shrinkage factor is required is because pressure is constantly applied to the plastics during the curing time.

The steps just described produce the female half of a metal forming or stamping die. In order to produce the male half or punch, the female plastics die is loaded in a mold box with a suitable parting agent on its surface and the various steps are repeated. When necessary, the female plastics die is covered with

Stokes-Windsor Extruders are in successful and profitable use by leading companies

A partial list of these manufacturers is given at right, with a statement of the products they are making.

Stokes-Windsor Extruders have become a "success story" during the last 18 months, and the demand for the products of these unique machines makes the future appear extremely bright. Sheeting, sections, hose, welting, and rigid pipe are some of the products. Rigid and elastomeric PVC, polyethylene, cellulose acetate, butyrate, polystyrene, Kel-F and others, are among the materials. These versatile machines are also finding growing acceptance for compounding, coloring and extruding in a single pass from pre-blended powder formulations.

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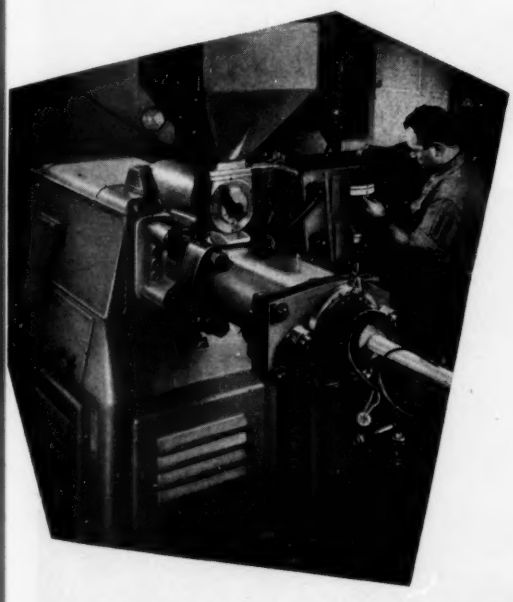

Stokes-Windsor Extruder is shown producing PVC rigid pipe. Complete take-off equipment can be provided, including water bath, pulling rolls and automatic cut-off saw.

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for rigid PVC pipe

AMERICAN AGILE CO. Maple Heights, Ohio
for rigid PVC pipe and sheeting

BOLTA COMPANY Lawrence, Mass.
for rigid PVC pipe and rod extrusion

CARLON PRODUCTS, INC. Cleveland, Ohio
for rigid PVC pipe

CLOPAY CORPORATION Cincinnati, Ohio
for rigid PVC pipe — elastomeric PVC sheeting

COLONIAL PLASTICS Cleveland, Ohio
for rigid PVC pipe

DEWEY & ALMY Cambridge, Massachusetts
for the evaluation of various vinyls and other resins for extrusion

DOW CHEMICAL CO. Midland, Michigan
for rigid PVC; compounding and coloring of polystyrene

FIRESTONE CHEMICAL COMPANY Pottstown, Penna.
for rigid PVC experimentation

FIRESTONE TIRE & RUBBER Akron, Ohio
for small cross-sectional rubber extrusion

GARLOCK PACKING CO. Palmyra, New York
for extrusion of, and development work in, Kel-F, nylon and polyethylene

GUSTIN-BACON Kansas City, Kansas
for development project

JOHN W. HANCOCK, JR., INC. Roanoke, Virginia
for polyethylene pipe and tubing

HEDWIN CORPORATION Baltimore, Maryland
for elastomeric PVC sheeting and rigid PVC extrusion

IDEAL TOY CORPORATION Long Island, N. Y.
for plasticized PVC scrap reclamation; compounding and coloring of PVC and polystyrene

LAWRENCE PROCESS CO. Lawrence, Massachusetts
for elastomeric vinyl sectional extrusion, garden hose, shoe welting

NATIONAL BUREAU OF STANDARDS Washington, D. C.
for development work

RIVERDALE PLASTICS Jersey City, New Jersey
for cellulose acetate and polystyrene scrap — reclamation and compounding and coloring of virgin material

VIPLAX PRODUCTS Beverly, New Jersey
for rigid PVC pipe

YARDLEY PLASTICS Columbus, Ohio
for rigid PVC and butyrate pipe; cellulose acetate extrusion; elastomeric vinyl sectional extrusion

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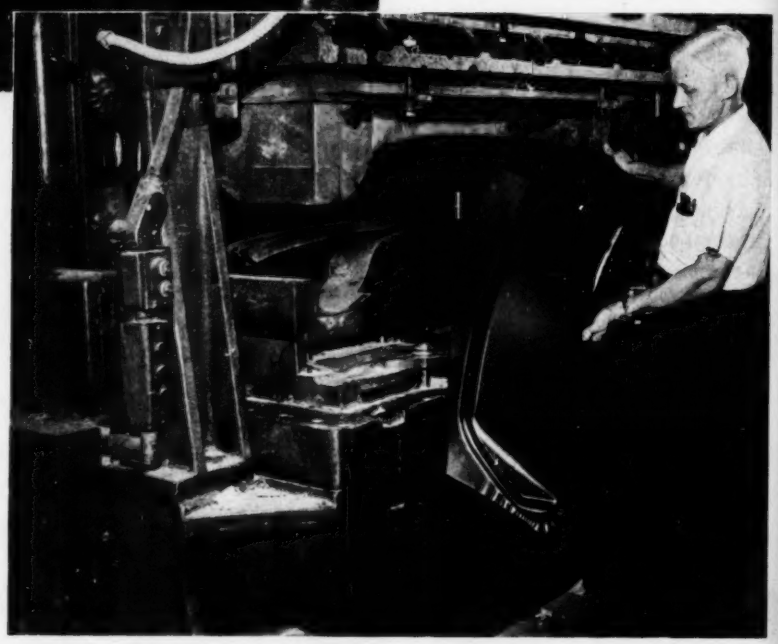
Punch press operator loading a cold rolled steel blank into a large reinforced plastics die. See photo below

Cold rolled steel blank (see above) has been formed by the reinforced plastics die into automobile sun visor



lead foil or wax to provide clearance between punch and die.

If very sharp corners are required, which are difficult to draw in steel, appropriate sections of the plastics die can be reinforced with steel inserts. These inserts are simply loaded into the lay-up and become securely bonded during cure.

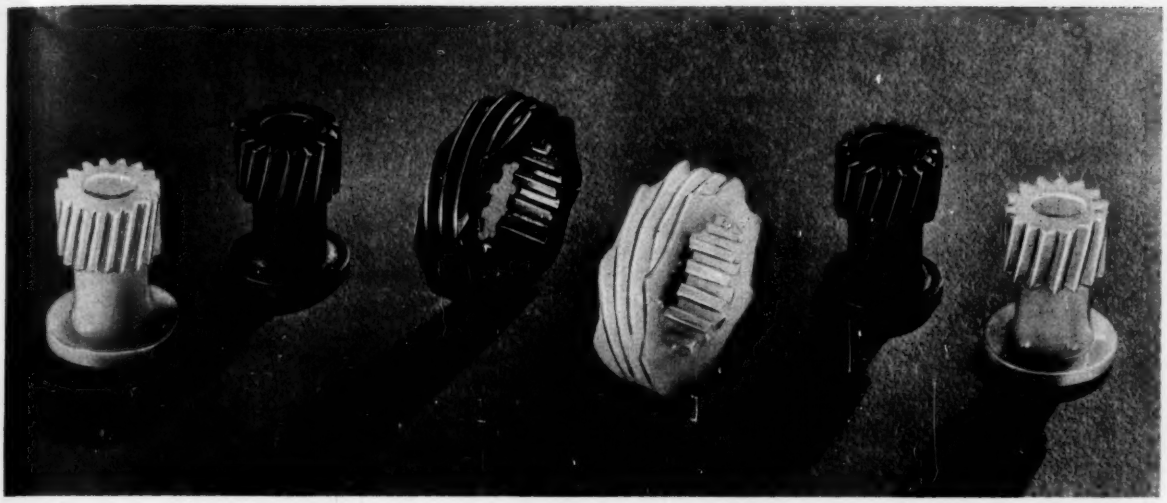
Another feature of this type of die and punch is that when and if certain sections should wear, repair is simple and can be completed quickly by the addition of tailored areas of glass and resin.

Proof

These reinforced plastics dies and punches are being made by Briggs for its own use as well as for other metal fabricators. Added proof of satisfaction is the following quote from a letter written by Commerce Engineering Co., Centerline, Mich.: "We are very pleased with the results we received by using the plastics dies you supplied us. We fabricated parts with these dies from 20-gage cold rolled steel and did not use a preform operation. We plan to use this type of die in all our future steel fabrications. Incidentally, the quotation for a punch and die made in steel was $4000; as you know, your price for the plastics die was between $400 and $500."

Other complimentary comments from users of the Briggs dies prove that this development of plastics forming tools for steel parts is an outstanding success. There can be little doubt that their use will continue to expand.

Many aircraft components are being drawn with reinforced plastics dies. The part which has just been removed from the press was formed from stainless steel sheet



A transmission speedometer driving gear and two transmission governor pinion gears used by Packard in their speedometers have been changed from metal to nylon. The two pinions and the one drive gear are shown above in both nylon and metal

Engineering Nylon Gears

Use of nylon gears expands as Packard replaces metal gears in its speedometer drive assembly

by J. H. Kuhn*

NYLON gears for the automotive industry have come of age with the introduction by Packard Motor Car Co. of the first all nylon gear train in their Ultramatic Drive transmission for their 1953 models. This successful application of nylon culminated after three years of research by Packard's engineering department and an eleven month injection molding development program by MacDonald Mfg. Co., New Baltimore, Mich.

Packard previously had experience with a transmission speedometer pinion and shaft assembly which incorporated a nylon helical gear molded on a steel shaft. Good results obtained from this application lead them to consider changing their transmission governor pinion and transmission speedometer driving gear from metal to nylon. However, dimensional tolerances on the new nylon gears had to be held extremely close compared to the previous molded gear; furthermore, a 77° helix angle driving gear had never before been molded. Four factors in favor of nylon—quietness, wearability, weight saving, and cost saving—decided the issue.

Advantages of Nylon

Nylon gears run together silently without the noise concomitant with metal gears. This characteristic is extremely important because it eliminates the necessity of adhering to the close dimensional tolerances which are necessary with metal gears to reduce mechanical vibration. Extensive wear tests have proved that nylon stands up well.

The change to nylon from steel in the case of the governor pinions and a brass forging in the case of the driving gear produced a weight saving of 87 per cent.

The most notable advantage of nylon gears versus metal gears lay in the great saving realized in costs. Gears can be injection molded with gates trimmed by the press operator and packed for shipment at production rates that make negligible the high per lb. cost of nylon compared to per lb. costs of metals.

Designing and building of the four-cavity production molds was complicated by the varying mold shrinkage characteristics of nylon. Differences in wall sections, size and location of gates, and shape and size of gears were controlling factors.

The planned procedure adopted at the beginning of the program involved building of production molds with cavities that would produce the part minus the teeth. Shrinkage data obtained from these sample parts were utilized in determining the proper mold shrinkage factor for dimensioning the cavities and cores.

One cavity of each part was then machined and installed in the production mold bases. This one cavity and the three blank cavities were run to produce the initial gears. The first sample gears were at considerable dimensional variance with print dimensions and lead and involute charts yielded results which, to those familiar with the usual standards of fine gear manufacture, would be considered extremely poor. However, they were checked for backlash at temperatures between −20 and 310° F.

Test Results

The gears were also fixture tested under a loading established as a check on speedometer and governor

(*Continued on* p. 118)

* Vice pres., MacDonald Mfg. Co.

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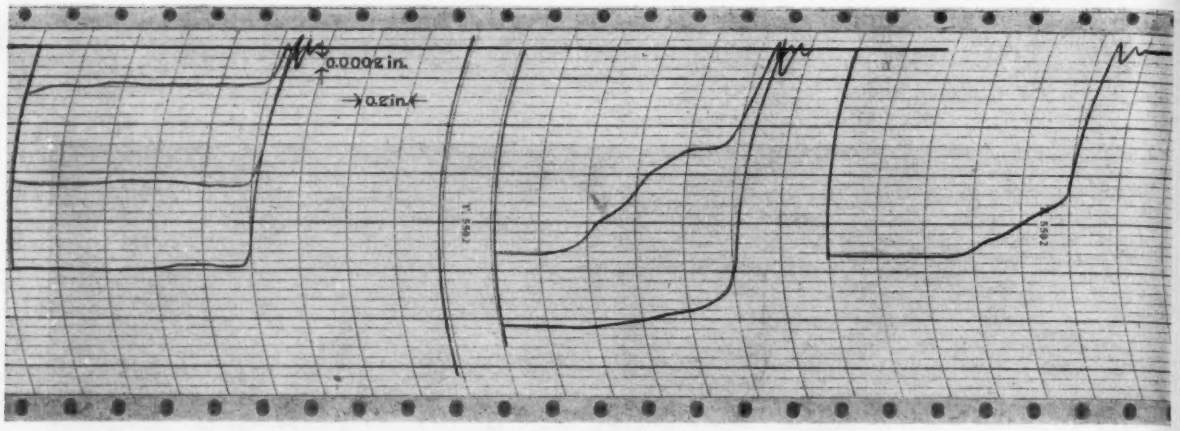
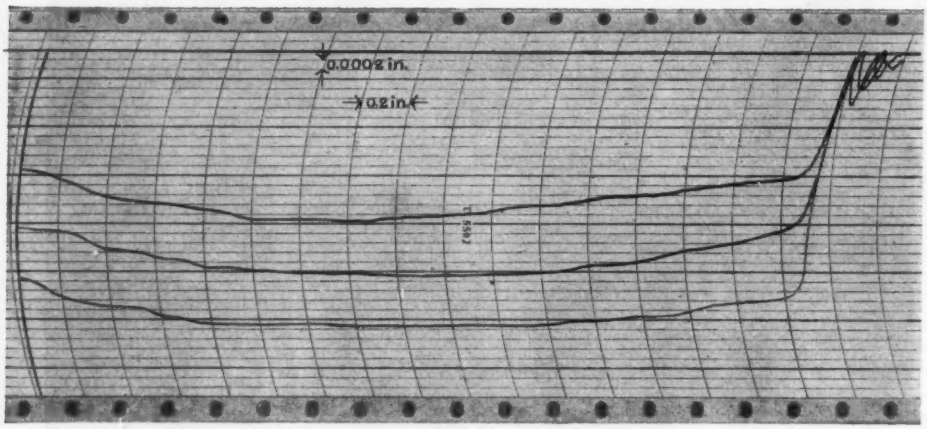
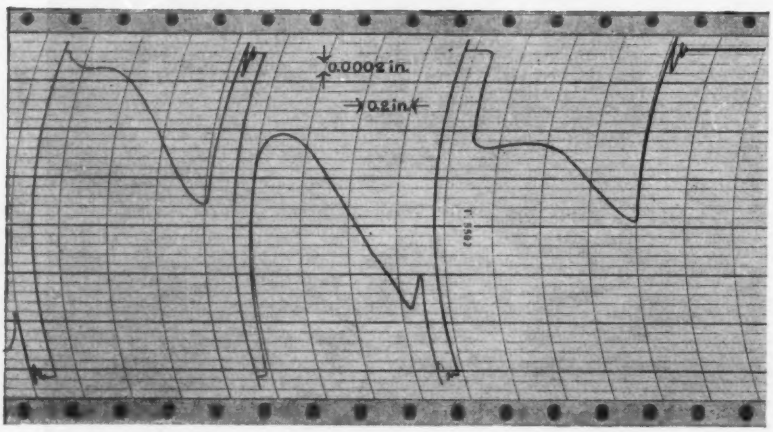






Involute profile and lead of gear teeth are checked for accuracy on special instruments. Above: The charted record of an involute check of six teeth on a nylon transmission speedometer driving gear. Left: An involute check record of three teeth of a 14-tooth pinion. Below, left: Chart of lead check on a 16-tooth pinion gear

gears. The result seemed to be satisfactory even with existing irregularities, but since the dimensions varied so greatly from the print (for example, the lead on the 14-tooth pinion gear was off approximately 0.028 in. and the 16-tooth pinion had a pitch diameter runout of 0.0075 in.), it was decided to proceed with new cavities, utilizing the sample gear cavities as guides to correct for incorrect dimensions. The original samples were road tested at the Packard Proving Grounds, and, amazingly enough, ran for 48,463 miles without showing signs of wear, despite the obvious errors in dimensions.

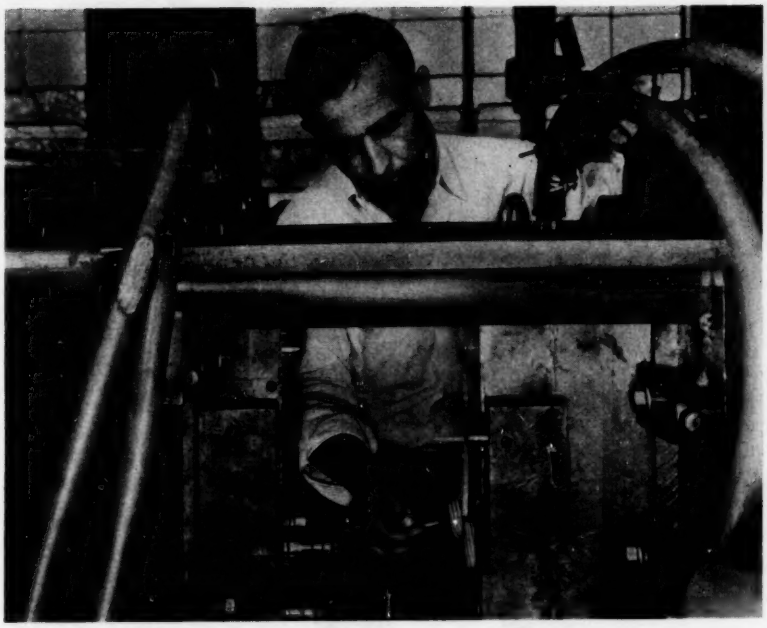
The final production molds, built by Beauchamp Plastic Molds, Inc., Hazel Park, Mich., with cavities designed and supplied by the Fellows Gear Shaper Co., Springfield, Vt., and the N. A. Woodworth Co., Ferndale, Mich., produced gears that maintained pitch diameter runout within 0.002-in. F.I.R. and kept parallel surfaces running true within 0.0015-in. F.I.R. Extreme care in mold building was required; all holes embodied in the entire die bases were jig bored and jig ground to insure the accuracy required.

Three charts presented with this article show some of the best results obtained in "lead"—an indication of the correctness of helix angle, and "involute"—an indication of the correctness of the profile. These data were obtained from a Fellows lead checker and a Fellows involute measuring instrument. The distance between each pair of fine horizontal lines represents 0.0002 inch. These charts were made after correcting the cavities for shrinkage in the molding process, as was disclosed by the original sample cavities.

A perfect lead or involute on such charts as those reproduced here would show a straight line. However, the fall-off from a straight line, as shown in two of the charts re-

sults in a thinner tip which actually is an advantage because it will give smoother action between mating gears as the teeth move in and out of contact under load. This thinner tip also tends to minimize the cantilever beam effect and results in a stronger tooth and less likelihood of fracture at the base.

It was found that the 77° helix angle worm gear tended to shrink more at the center of the face width than on the ends, resulting in a slightly concave tooth face. This is attributed to the fact that the teeth feather out at the ends and, being of thinner wall section than the fully formed tooth in the effective face width of the gear, do not shrink as much. The resulting concavity on the face actually spreads the bearing load between worm and pinion over more area on this cross-axis drive application and is a service life gain rather than a loss. The result is similar to that obtained from a worm and worm wheel.



Four-cavity production mold for nylon transmission speedometer driving gear, in open position, with the operator removing one gear and its core pin from the mold

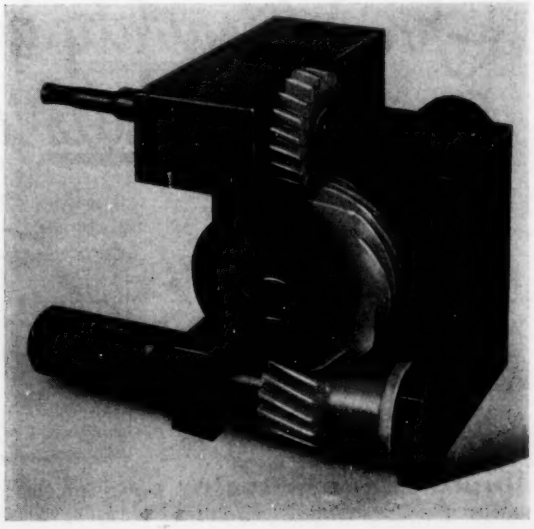
Conclusions

Several observations regarding mold shrinkage of nylon can be made from this work. In general, it has been found that the base circle from which the involutes are generated shrinks in an approximate proportion to other diametral changes. So, too, the lead or helix changes seem to be in a fairly predictable pattern once molding conditions have been stabilized and shrinkage established. The amount of change in the tooth profile—called pressure angle—is in approximate proportion to diametral shrinkage. Therefore, the pressure angle of the teeth in the cavity had to be made lower to compensate for this change.

The gears were molded in a Fellows-Leominster 5C-8-oz. injection molding machine. Nylon material used was Du Pont FM-10001 F-1000 Natural. Production cycles of 39 sec. and 52 sec. were obtained. The pinion gears were ejected automatically, while the worm gear was manually unscrewed. The pinion gears were pin-point double gated to obtain the desired concentricity, but the worm gear was single pinpoint gated. The 77° helix angle with a 1.4330-in. lead on the worm gear allowed the nylon to flow around the center core with slight resultant eccentricity. Mold temperatures were stabilized at 110° F.

If any general conclusions as regards accuracy required in nylon gears can be drawn, they might be that: 1) Involutes with modified tips seem to perform better. 2) The horny flexibility or resiliency of nylon will permit much greater variation in dimensions than is permissible in steel yet still give good service life. 3) The limits of tolerance on nylon gears for the usage described could be more correctly specified in thousandths rather than in ten-thousandths common to metal gear manufacture without serious detriment to service life, provided back-lash is not a critical factor.

Though it does not appear possible, as stated above, to obtain accuracies in nylon gears equivalent to those obtained in the precision machining of metals, the molded product if properly controlled in its manufacture, will out-perform its precision metal counterpart on the following points: a) Quietness of operation. b) Length of service life. c) Cost of manufacture.



Three nylon gears in the speedometer train mounted in an accurate checking fixture which is designed so that the pinions can be driven by the nylon drive gear in simulation of actual operation on the road

71

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PLASTICS*
TECHNICAL SECTION: Dr. Gordon M. Kline, Technical Editor

Oxidative Aging of Polyethylene†

by B. S. Biggs and W. L. Hawkins**

The thermal oxidation of polyethylene follows the pattern set by lower homologues such as paraffinic waxes and oils. It is an autocatalytic free radial chain reaction and is subject to inhibition by typical antioxidants. The rate of degradation in the dark at room temperature is found to be extremely low. Photo-oxidation of polyethylene is rapid in contrast with that of saturated low molecular weight aliphatic hydrocarbons. Furthermore, antioxidants are of little benefit in protecting against exposure to light. Opaque pigments are of great value in reducing the effects of light, finely divided carbon black being particularly effective. By proper compounding polyethylene can be made to last many years outdoors.

WHEN polyethylene became available as a commercial material in the late 1930's, many people, being familiar with the reputed chemical inertness of paraffin wax, expected this new hydrocarbon polymer to have great inherent stability. It became apparent very soon, however, that pure unprotected polyethylene was subject to thermal oxidation at elevated temperatures and that it was also oxidized rapidly on outdoor exposure, losing its original properties in only a few months. During this development period some serious misapplications of polyethylene were made. As experience grew these were largely eliminated and today it is being used to advantage in many ways. As with many polymers, it has been necessary to suit the material to the application by appropriate compounding modifications. The purpose of this paper is to discuss the nature of the deterioration reactions of polyethylene and to describe some means of retarding them.

There are many papers in the literature testifying to the ease of thermal oxidation of paraffinic hydrocarbons. Francis and his associates (1, 2, 3, 4)[1] oxidized paraffin wax at temperatures in the neighborhood of 100° C. and obtained as products water, formic acid, ketones, hydroxy compounds, and long fatty acids. Haslam and Frolich (5) oxidized highly refined mineral oil at 130° C. and found acids and other oxygenated compounds in the product. Dornte (6), Balsbaugh and Oncley (7), Von Fuchs and Diamond (8), and Larsen, Thorpe, and Armfield (9) carried out extensive experiments with saturated aliphatic hydrocarbons and found that they are easily oxidized and follow an autocatalytic oxidation curve. It was also well established that their oxidation is subject to inhibition and is therefore presumably a chain reaction. In the light of these facts it should not have been surprising to find that polyethylene, which is a larger homologue of these compounds, is also easily attacked by oxygen at elevated temperature. Its susceptibility to photo-oxidation is more surprising and this will be discussed at greater length later.

Mechanism of Oxidation

The oxidation of polyethylene is most easily observed by milling the plastic on a hot mill. The viscosity decreases and the power factor, initially very low, increases rapidly. Antioxidants are effective in preserving the high molecular weight and the low power factor (Fig. 1). The oxidation and its inhibition may also be observed in oxygen absorption studies carried out at 150° C. Figure 2 shows curves of such oxy-

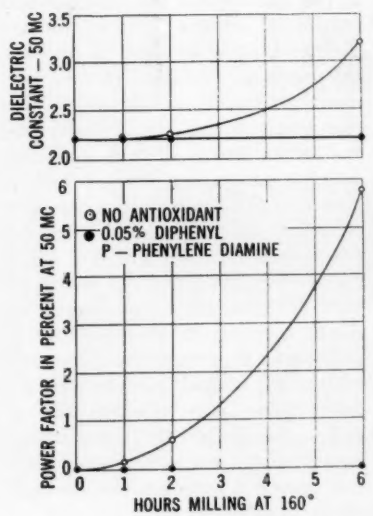


Fig. 1—Stabilizing effect of antioxidant on electrical properties of polyethylene during milling, compared with results when antioxidant is absent

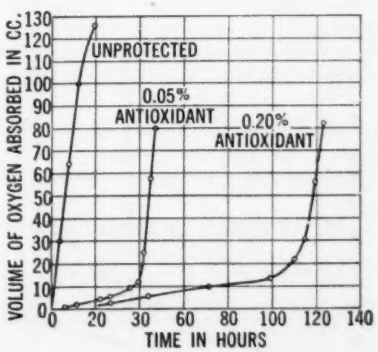


Fig. 2—Effect of antioxidant on the oxygen absorption by polyethylene in oxygen at a temperature of 150° C. (1-g. samples in 4- by ⅝-in. boats)

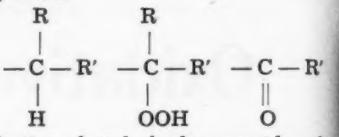
* Reg. U. S. Pat. Off.
† Based on a paper presented at the Polymer Degradation Symposium, National Bureau of Standards.
** Bell Telephone Laboratories.
[1] Numbers in parentheses link to references at end of article.

gen absorption for polyethylene with and without antioxidant.

The question of where and how the polyethylene chain is attacked is an interesting one and something can be learned about it by turning attention again to small molecules. The order of decreasing stability of hydrogen atoms in saturated hydrocarbons is known to be primary, secondary, and tertiary (10, 11, 12, 13, 14, 15). Thus, highly branched hydrocarbons are resistant to oxidation if all the methyl groups are paired (neopentane), but are reactive if single methyl or other alkyl groups (and therefore tertiary hydrogens) occur along a chain. The stability toward oxidation of a methyl silicone polymer, which is about 33% hydrocarbon, probably resides in the fact that all the hydrocarbon portion is in the form of methyl groups. It is of interest to compare the rates of oxidation of two isomeric compounds of formula $C_{16}H_{43}$, one being normal hexadecane and the other being diethyl dodecane which contains two tertiary hydrogens (Fig. 3). Polyethylene has been reported on the basis of infra-red absorption evidence (16, 17, 18) to contain branches, and the associated tertiary hydrogen atoms would no doubt increase its susceptibility to oxidation. However, the secondary groups of normal hexadecane are seen to be quite reactive enough and we can assume that polyethylene would be subject to thermal oxidation even if it were a perfect straight chain paraffin.

The mechanism of the oxidation is assumed to be that generally accepted for aliphatic hydrocarbons uncomplicated by unsaturation. The presence of occasional double bonds, like occasional tertiary hydrogens, would undoubtedly facilitate the initiation step by formation of the first peroxide group, but if we can judge from the easy oxidation of simple paraffins such points of increased vulnerability are not necessary. The source of the first radicals is a matter of speculation. It may be that radicals are formed by dissociation of -C-H or -C-C bonds in the segments of highest energy, or perhaps hydroperoxide groups can be formed by direct union with oxygen, and their decomposition can produce the first radicals. Once hydrocarbon radicals are produced, it can be assumed that they react with oxygen to form peroxidic radicals and these in turn abstract hydrogen from other molecules of substrate and repeat the process. Due principally to the work of the British Rubber Producers Research Association (19, 20, 21), these steps are now well-known and widely accepted and need not be repeated here. Antioxidants act as chain stoppers by interposing themselves in the chain reaction at an early stage and terminating it by leaving a radical too inert to react with oxygen (22). That they are quite effective in molten polyethylene is shown by Fig. 2 cited above.

The free radical chain reaction described above results in the introduction of hydroperoxide groups into the polyethylene chain. Its autocatalytic nature derives from the decomposition of these peroxides into new free radicals. These reactions would be adequate to account for the increase in power factor of polyethylene. The fact that there is an attendant decrease in viscosity means that somewhere in the series of reactions scissions of the carbon chains occur. There is abundant evidence that decomposition of tertiary hydroperoxides can result in chain scission. Stephens (23) showed about 20 yr. ago that dialkyl phenyl methanes on oxidation give phenyl alkyl ketones, the longer alkyl group being split off.



Tertiary-butyl hydroperoxide decomposes similarly with formation of acetone. George and Walsh (24) have described similar scissions of carbon bonds in the decomposition of tertiary hydroperoxides of methyl cyclohexane and methyl cyclopentane.

There is less direct evidence for chain scission in secondary peroxides, although it is apparent that scission occurs at some point in the sequence of reactions since short chain fatty acids are produced in the oxidation of paraffin wax and octadecane.

Bateman (25) has suggested on kinetic grounds that the chain scission in rubber occurs in the decomposition of the peroxidic radical ROO· rather than in that of the hydroperoxide. Regardless of which mechanism is correct, the fact is that unprotected polyethylene does undergo chain scission and is ultimately degraded to a material with little more structural value than paraffin wax.

Thermal Oxidation

Although the most rapid degradation of polyethylene in service has been in outdoor exposure, it is of interest in the laboratory to study the purely thermal oxidation. The technique employed in these experiments consisted of heating the samples in an atmosphere of oxygen in suitable glass vessels, which also contained barium oxide to absorb water and carbon dioxide. The vessels were connected through the wall of the oven by capillary tubing to gas burettes in which the consumption of oxygen was measured. The pressure was kept substantially constant by frequent readjustments of the leveling bulbs.

The measurement of the true rate of oxygen absorption of a given mass of polyethylene is difficult because the slow rate of diffusion of oxygen limits the reaction. Even at 150° C. melted polyethylene is still too vis-

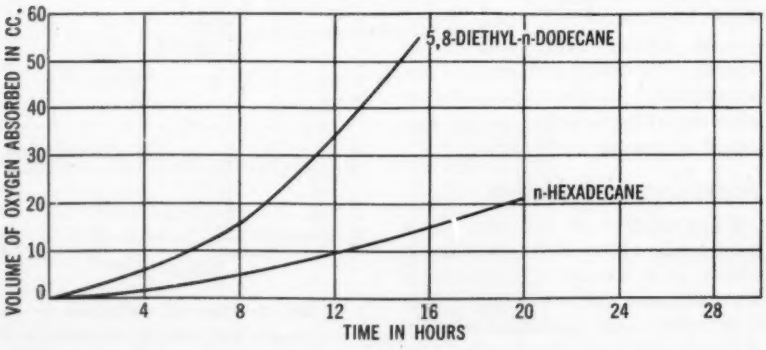


Fig. 3—Oxidation of isomeric hexadecanes in oxygen at 105° C. (3-ml. samples)

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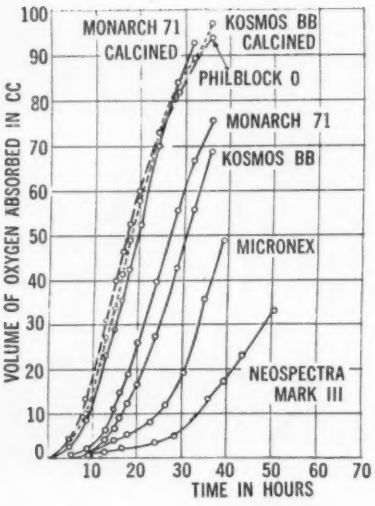

Fig. 4—Effect of 1% carbon blacks in polyethylene on its oxidation in oxygen (1-g. samples in 4¾- by ⅝-in. boats)

cous to permit effective agitation except on a hot mill. It has been found that the limiting thickness of polyethylene film which will permit reaction at a rate proportional to mass rather than surface area is between 1 and 5 mils. At 90° C., samples of equal weight prepared by slicing a block of material with a microtome oxidize at equal rates at thicknesses of ½ and 1 mil, but not at 5 mils. Such thin chips cannot be used above the melting point, of course, because they fuse together. Attempts have been made to support thin films of melted polyethylene on glass cloth, but it is difficult in such experiments to be certain that the maximum thickness is kept below the critical level. The oxygen absorption curves shown in Fig. 2 were obtained on thin samples contained in aluminum boats of fixed size so that the same area of surface was exposed to oxygen in each case. This method is satisfactory for obtaining comparative rates particularly when comparing the effectiveness of different antioxidants. These curves show the remarkable effectiveness of antioxidant in molten polyethylenes.

It was observed by V. T. Wallder and J. B. DeCoste in this laboratory that carbon black retards the lowering of viscosity of polyethylene during hot milling just as do chemical antioxidants. Oxygen absorption experiments using the boat method confirm the effect (Fig. 4) and show that, in general, the channel blacks or high-acid blacks are more effective than the furnace blacks, although at best they are much less effective than good chemical antioxidants. Calcining the channel blacks lowers their effectiveness. It is interesting to note that the presence of carbon black produces an induction period which is finally overcome, just as is the case with chemical antioxidants. It is known that carbon black is effective in deactivating free radicals and presumably the antioxidant action is related to this property.

Study of the oxidation of polyethylene at high temperatures is important because the polymer is normally compounded and processed at temperatures above its melting point, but in service it is usually near the temperature of the atmosphere, and hence it is of great interest to see how it ages in the solid state.

As has been pointed out by Wallder (26), measurement of the low temperature brittle point is a convenient method of following the deterioration of polyethylene and this has been used in several studies. It has been found, for example, that a sample of unprotected polyethylene that has been stored in the dark at room temperature for 10 yr. still has a brittle point below −76° C., evidence that its rate of oxidation under these conditions can be considered negligibly slow. At 90° C. the rate is fast enough to be measured and it was found that the brittle point of strips ¼ in. wide and $\frac{1}{16}$ in. thick was raised to above −40° C. by a 500-hr. exposure to oxygen at that temperature. At this point the weight of oxygen absorbed was 0.0085 g. per gram. Samples containing antioxidant reached this brittle point after 5500 hours. Brittle point measurement by the impact method is quite sensitive to changes in the brittleness of the surface layer and it may be that the deterioration of these samples was largely in the region of the surface.

Antioxidants are extremely effective in lowering the rate of oxygen absorption of polyethylene even in the solid state. This is shown in Fig. 5, which presents oxygen absorption curves at 90° C. for two samples of "pure" polyethylene representing different batches of material and for a third sample which was supposedly pure polyethylene but which had been stored for about 2 yr. in a drawer that also contained inhibited material. The trace of antioxidant which migrated to the pure material was enough to produce a very long induction period. All these samples were in the form of shavings 1 mil thick. Even fresh samples of "pure" polyethylene vary considerably in the length of the induction period probably because of traces of impurities picked up during processing operations. Thus, of the two samples studied in this experiment, one had an induction period of about seven days and the other of about 12 days. Such behavior is the common experience with small molecules which have been given only superficial purification; so it is not surprising to find it with a polymer which cannot normally be given any effective purification.

The evidence cited above indicates

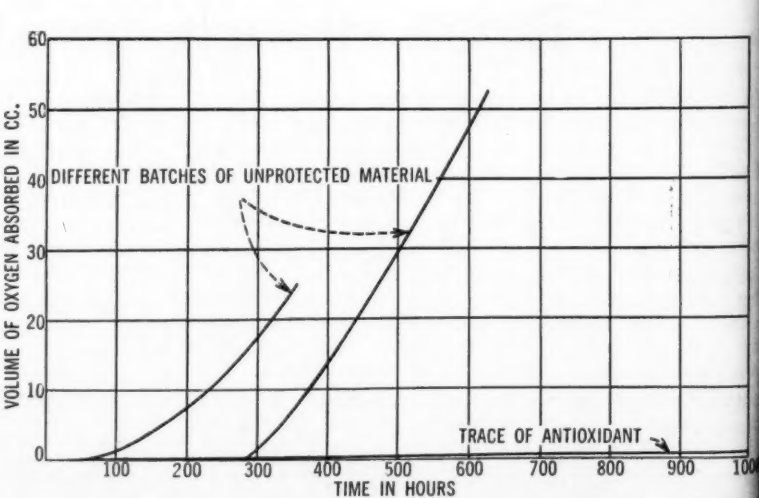

Fig. 5—Oxidation of polyethylene in oxygen at 90° C. (1-g. shavings, 1 mil thick

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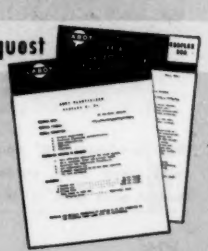

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that for applications at normal temperatures and not involving exposure to light, properly inhibited polyethylene can be expected to last indefinitely. Such is not the case when the material is to be used outdoors. Polyethylene free of protective agents is deteriorated beyond satisfactory use by a few months' exposure to summer sunshine in New Jersey. A sample of unprotected polyethylene sheet 75 mils thick, which had been exposed outdoors for about 3 yr. and had become quite brittle (Fig. 6), was found to contain 3% oxygen. Even heavy dosages of antioxidant do not prolong the outdoor life of polyethylene to more than a year or two. Apparently, the rate of initiation of oxidation chains by sunlight is high enough to overwhelm any practical amount of antioxidant, particularly since the antioxidant is also being destroyed at the same time by its own independent oxidation.

Outdoor Test Simulation

While the most reliable information on outdoor exposure of various polyethylene compounds obviously is obtained by actual outdoor tests (and this constitutes a necessary adjunct to any program in the study of deterioration, see Figs. 7 & 8), these are usually too slow to be used for the guidance of development work. Wallder and associates (26) have found that exposure to a bare carbon arc can be used to great advantage as an accelerated test for polyethylene and they justify this use of light waves shorter than are found in sunlight by an empirical calibration against nine years of outdoor exposure. They arrive at a rough correlation which states that exposure for 100 hr. to the bare carbon arc under prescribed conditions is equal to exposure for one year outdoors. The test is probably less fair to transparent samples than to opaque ones, but that is unimportant since only the opaque ones have any practical value for outdoor use.

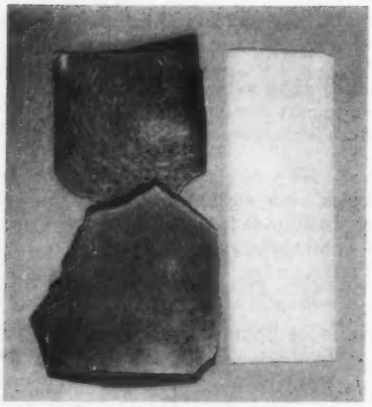
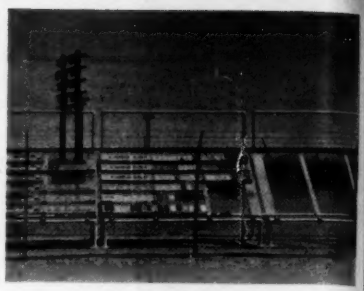
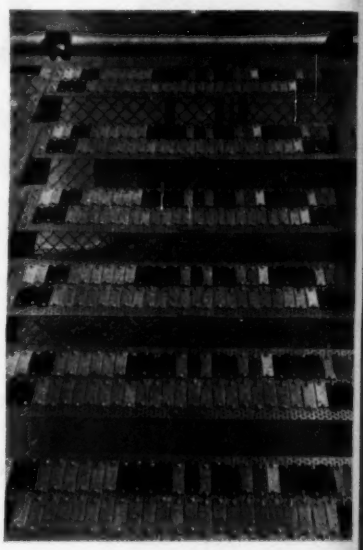


Fig. 6—Sample of polyethylene which was aged 3 yr. outdoors (top), compared with part of the original sheet

The rapid photo-oxidation of polyethylene outdoors is surprising when one considers that it is a saturated aliphatic hydrocarbon and, therefore, should not absorb light of the solar spectrum. Octadecane, for example, is not measurably oxidized at room temperature by exposure to ultra-violet light. The light absorption curve of polyethylene has been reported by Maibauer and Myers (27) and by Pross and Black (28), and shows a low but definite absorption throughout the lower end of the solar spectrum, although there are no apparent resonance peaks above 2500 Angstroms. Whether this absorption is due to very low concentrations of known groups is not established. Pross and Black attribute it to small traces of carbonyl. In any case, it can be demonstrated in the laboratory that polyethylene, in contrast with octadecane, oxidizes fairly rapidly at room temperature under exposure to ultra-violet light.

It has already been stated that there is little hope of giving polyethylene a usefully long outdoor life by the use of chain-stopping additives alone. It is necessary to protect it from ultra-violet light. This has been done with some success in other polymers by use of organic absorbers of ultra-violet light, such as phenyl salicylate (29) and dihydroxy benzophenone (30), but these substances have been found of little practical benefit in polyethylene. Studies have been made of the protective effect of pigments and a few have been found helpful, notably lead chromate, iron oxide, and carbon black. The last is by far the best. Wallder, Clarke, Howard, and DeCoste, in the paper cited earlier, have published the results of an extensive study of the protection of polyethylene by carbon black, and their paper should be consulted for details. They show that 2% of a finely divided black, well dispersed in the polymer, increases the life in accelerated tests at least 30 fold. They also report actual outdoor aging of nine years, and show that samples containing 1% of black are still in good condition after that period of exposure in Florida. On the basis of this work, it is expected that polyethylene properly compounded with carbon black and antioxidant will retain useful properties for many years.





Figs. 7 and 8—Typical outdoor exposure plot for plastics samples (top), and close-up of rack with multiple panels of polyethylene samples (below)

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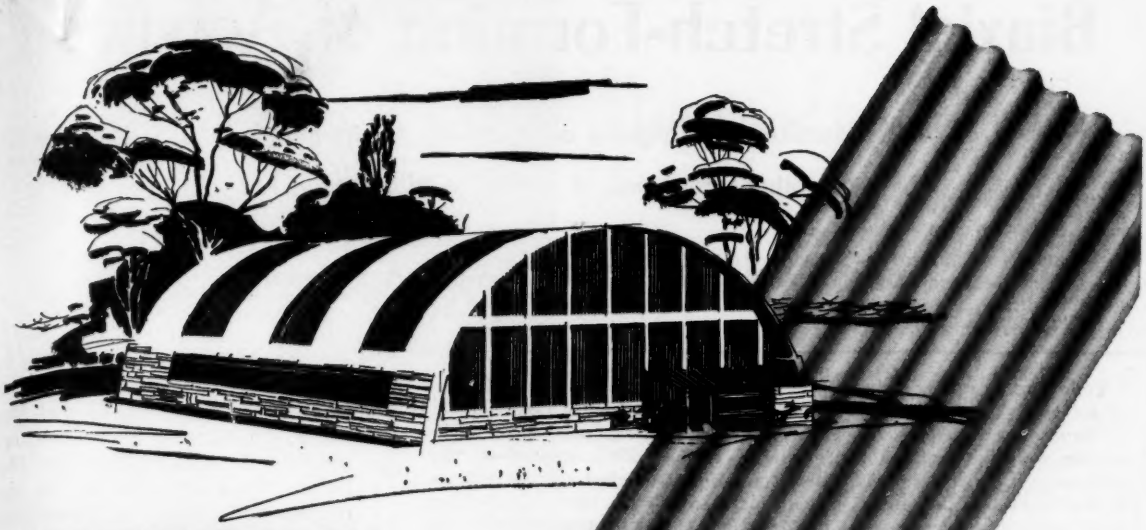

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Biaxial Stretch-Forming of Acrylics

Effects of high degrees of stretching on crazing and other properties of acrylic plastic glazing

by I. Wolock*, B. M. Axilrod*, and M. A. Sherman*

Following an earlier investigation of the effects of biaxial stretch-forming of polymethyl methacrylate to about 50% strain, the effects of higher degrees of forming were investigated. Sheets of commercial cast polymethyl methacrylate were hot-stretched approximately 100 and 150%, respectively, and tests were conducted on this material and on unstretched control material. It was found that the tensile strength increased for the 150% stretched material only; this increase was 6 to 12 percent. The elongation at failure was higher for the stretched materials than for the unstretched but decreased as the degree of stretching increased. None of the stretched specimens crazed in the short-time tensile tests. The threshold stress for stress-solvent crazing with benzene was equal to approximately three-fourths of the ultimate strength for the 100% stretched material, as compared with a threshold stress equal to approximately one-fourth of the ultimate strength for the unstretched material. Most of the specimens of the 150% stretched material did not solvent-craze at stresses very close to the ultimate strength. Thus, the resistance to crazing increased markedly with increasing degrees of biaxial stretching. The resistance of the stretched material to surface abrasion was found to be appreciably less than that of the unstretched material. A theory for the behavior of the stretched acrylic sheet is presented, based on a postulated molecular structure for this material.

PREVIOUSLY reported data (1)[1] indicated that moderate degrees of biaxial stretch-forming greatly improve the crazing resistance of cast polymethyl-methacrylate sheeting. The results showed that biaxially stretch-forming polymethyl methacrylate approximately 50% greatly increased the elongation at failure and the stress and strain at the onset of crazing in short-time tensile tests; in fact, most of the specimens tested did not craze in these tests. The forming also increased the threshold stress of stress-solvent crazing about 75 percent. In view of these results, an investigation was made of the effects of higher degrees of biaxial stretching on the tensile, crazing, and surface abrasion properties of acrylic glazing.

The materials used were commercial cast polymethyl-methacrylate sheets, Lucite and Plexiglas, of both general-purpose and heat-resistant grades (2) and were approximately 0.15 in. in thickness. The samples were obtained directly from the manufacturers and consisted of one sheet from each of two production runs for both grades of materials.

Apparatus and Procedure

Forming—The vacuum forming apparatus and operation are described in detail in a previous report (1). Briefly, a sheet of the plastic is heated in an oven to a temperature in the rubbery range, 130° C. for the general-purpose grade acrylic sheet and 160° C. for the heat-resistant material. The sheet is removed from the oven and clamped to a flanged cylindrical forming vessel. The vessel is partially evacuated, drawing the sheet down into the chamber in the form of a hemisphere. An open-ended cylinder is inserted into the hemisphere, clamped in place, and air is admitted to the forming vessel, causing the plastic to retract around the cylinder. The formed plastic has the shape of a top hat. Test specimens are taken from the 10-in. diameter flat top of the formed piece.

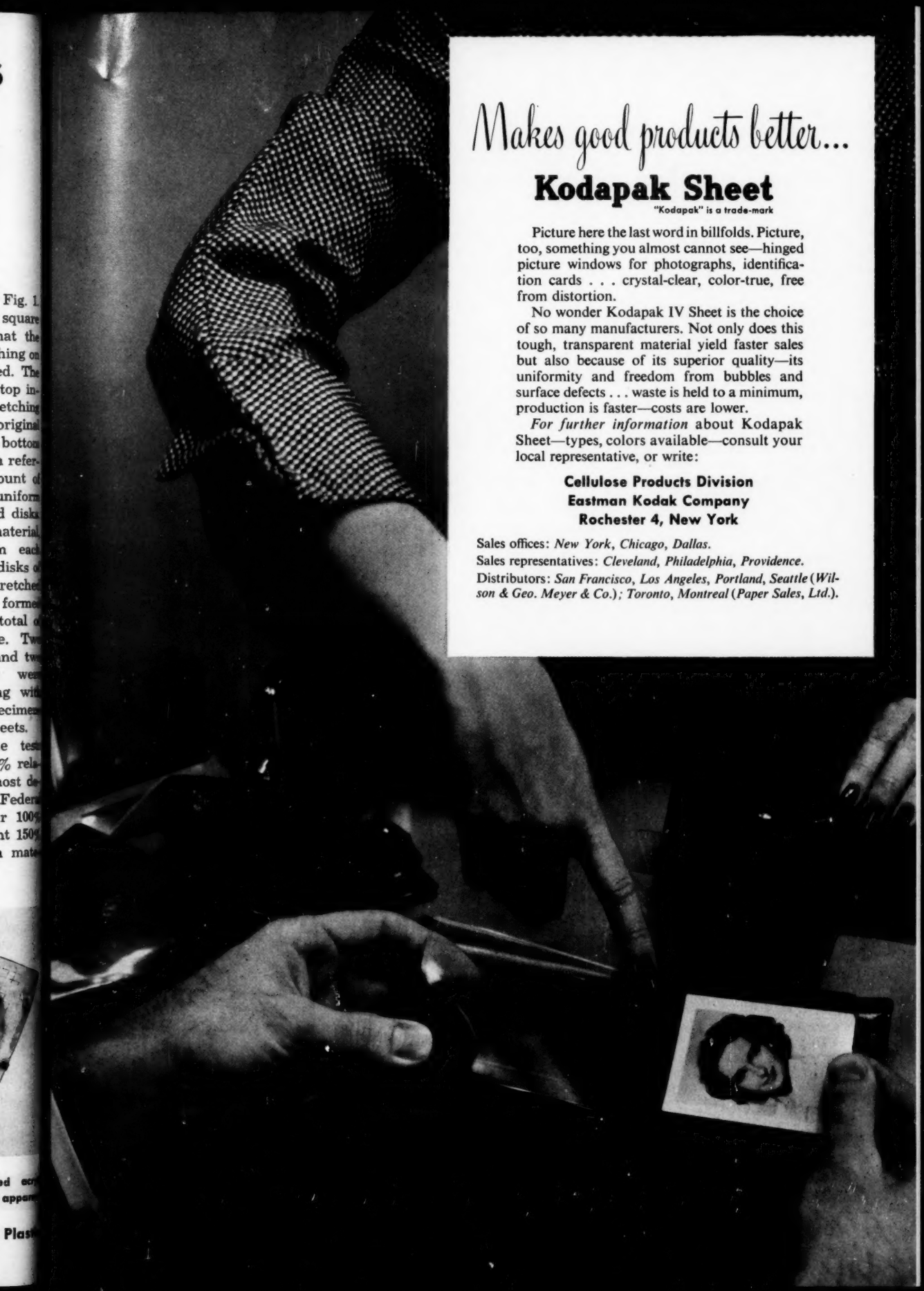
A formed hat is shown in Fig. 1. The sheet was marked off in square grids before stretching so that the degree of uniformity of stretching on the flat top could be observed. The length of squares on the flat top indicates the degree of stretching when compared with the original length of the squares on the bottom rim. Experiments described in reference 1 showed that the amount of stretching was reasonably uniform over the face of those formed disks.

For the 100% stretched material one disk was formed from each sheet, making a total of two disks of each sample. For the 150% stretched material, two disks were formed from each sheet, making a total of four disks of each sample. Two standard tensile specimens and two tapered tensile specimens were tested from each disk along with corresponding control specimens from the same respective sheets.

Tensile Tests—The tensile tests were made at 25° C. and 50% relative humidity following in most details Method No. 1011 of Federal Specification L-P-406a. Four 100% stretched specimens and eight 150% stretched specimens of each mate-

Fig. 1—Sample of formed sheet as removed from stretching appara-

* Organic Plastics Section, National Bureau of Standards.
[1] Numbers in parentheses link to references at end of article.



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rial were tested along with corresponding control specimens. The specimens were tested in a statistically randomized order and were conditioned at the test conditions for at least 24 hr. prior to testing. A testing speed of 0.05 in./min. was used up to 10% strain, at which point the speed was increased to 0.6 in./minute. Autographic load-extension curves were obtained on the unstretched control specimens with Southwark-Peters extensometers and the associated recorder. The strain gage was also used on the first few formed specimens tested. The knife edges of the gage, however, scratched the surface of the specimens, resulting in a tendency toward premature failure. Accordingly, the strain gage was not used for the majority of the formed specimens, so that load-extension curves were not obtained. The total elongation was measured with dividers for the formed specimens and also for those control specimens which elongated more than 10 percent.

Stress-Solvent Crazing—The tests were conducted on tensile specimens which tapered from a width of 0.500 to 0.333 in. over a 3-in. reduced section. In testing, a specimen was placed under a predetermined load in a hydraulic testing machine and a blotter, saturated with benzene, was pressed against the tapered portion of one face of the specimen for 10 seconds. The extent of crazing along the length of the specimen was noted after removal of the blotter while the specimen was still under load. The stress at the point at which crazing terminated was calculated as the threshold stress for stress-solvent crazing. The extent of crazing on the specimen was taken as that point below which there were no visible craze cracks.

Surface Abrasion—Tests of both formed and unformed material were conducted in accordance with Method No. 1092 of Federal Specification L-P-406a, using a Taber abraser. Light transmission and haze measurements were made following A.S.T.M. Method D-1003-49T, using a Hunter hazemeter. These measurements were made after 0, 10, 25, 50, 75, 100, 150, 200, and 250 revolutions of the abraser.

Tensile Tests

The results of the tensile tests on the formed and unformed specimens are shown in Table I. All of the results are shown graphically in Fig. 2, along with the results previously obtained on 50% stretched material. A statistical analysis of the data did not indicate any significant sheet-to-sheet variation and the standard errors reported in Table I were calculated on this basis. The data did not indicate an increase in tensile strength for the 100% stretched material. There was an increase in tensile strength, however, of about 6% for the general-purpose-grade Lucite specimens stretched 145 to 150% and about 12% for the Plexiglas specimens of both grades which were stretched 165 to 170 percent. The control specimens of heat-resistant-grade Lucite broke prematurely, so that there was no value obtained upon which to base any change in tensile strength upon stretching. The corresponding total elongations were considerably higher for the stretched specimens than for the unstretched, increasing from approximately 7% for the unstretched material to approximately 50 and 25% for the material stretched 100 and 150%, respectively. None of the stretched specimens crazed in the short-time tensile tests, which result might have been expected from the previously reported results on 50% stretched material, whereas the control specimens crazed at the usual strains varied from 2.3 to 3.4% for the different materials.

The fracture surfaces of the unstretched specimens and of the previously tested 50% stretched specimens had a mirror-like area in which, it was postulated, the fracture begins (1). This mirror-like area was observed on only a few of the 100 and 150% stretched specimens (Fig. 3). The laminar nature of the fracture surfaces was more pronounced in these highly stretched specimens than in the 50% stretched specimens (Fig. 4); and the fracture

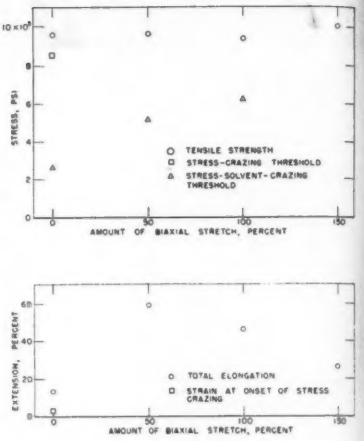

Fig. 2—Effect of biaxial stretching on tensile properties of acrylic at 23° C.

Table I—Effect of Biaxial Stretching on Tensile Properties of Polymethyl Methacrylate at 23° C.[a]

Material	*Biaxial stretch*	*Tensile strength*	*Elongation*	*Stress at onset of crazing*	*Strain at onset of crazing*
	%	p.s.i.	%	p.s.i	%
			Unstretched		
Lucite HC201	—	7460 ± 30	5.3 ± 0.2	6950 ± 30	2.7 ± 0
Lucite HC202	—	[b]	[b]	8690 ± 140[c]	3.3 ± 0.1[c]
Plexiglas I-A	—	7960 ± 20	10.6 ± 1.2	7110 ± 80	2.3 ± 0
Plexiglas II	—	9500 ± 30	7.4 ± 0.8	8810 ± 100	3.4 ± 0.1
			Stretched		
Lucite HC201	100	7680 ± 190[d]	51 ± 4[d]	Did not craze.	
Lucite HC202	100	9310 ± 240[d]	46 ± 2[d]	Do.	
Lucite HC201	145	7920 ± 30	30 ± 2	Do.	
Lucite HC202	150	10,030 ± 30[e]	26 ± 1[e]	Do.	
Plexiglas I-A	170	8890 ± 50[e]	25 ± 2[e]	Do.	
Plexiglas II	165	10,690 ± 50[f]	16 ± 1[f]	Do.	

[a]The tensile tests were made at 23° C. and 50% relative humidity, in accordance with Method No. 1011, Federal Specification L-P 406a. Testing speed was 0.05 in./min. up to 10% strain, at which point the speed was increased to 0.6 in./minute. All results are the average for eight specimens, unless otherwise noted, plus or minus the standard error.
[b]Seven of the eight specimens tested broke while the stress-strain curve was still rising and did not reach the probable maximum.
[c]Average of the three specimens which crazed.
[d]Average of four specimens tested.
[e]Average of seven specimens.
[f]Average of five specimens (three specimens broke in grips).

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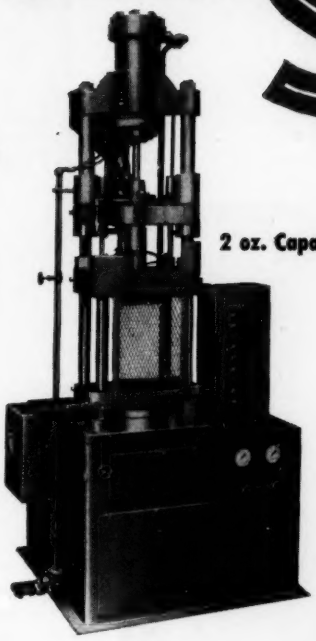

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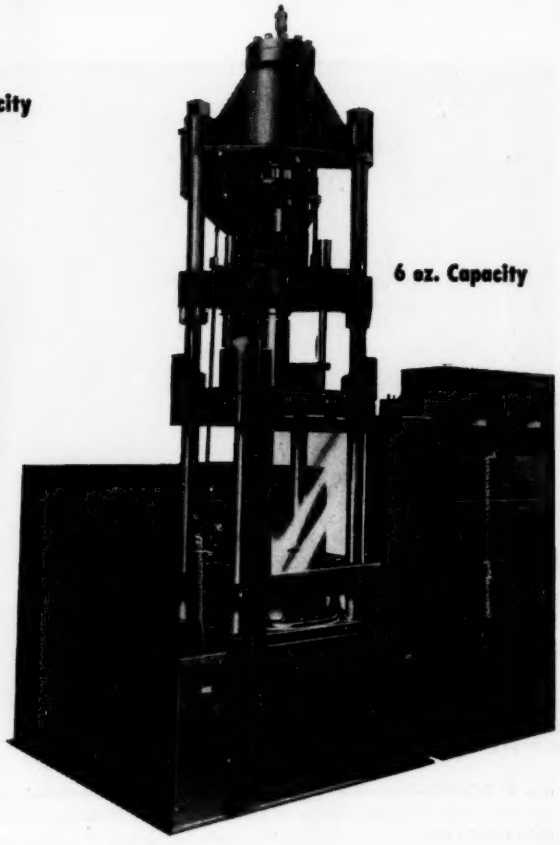

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surfaces were so small and laminar that detection of the glassy areas was usually quite difficult. The influence of orientation on the appearance of fracture surfaces is also shown by the fibrous nature of uniaxially stretched polymers previously noted by Houwink (3) and Cheatam and Dietz (4).

The results of the stress-solvent crazing tests are shown in Table II* and Fig. 2. The specimens of the unstretched materials crazed at stresses corresponding to approximately one-fourth of the ultimate strength upon application of benzene. The threshold crazing stress for the 100% stretched materials was

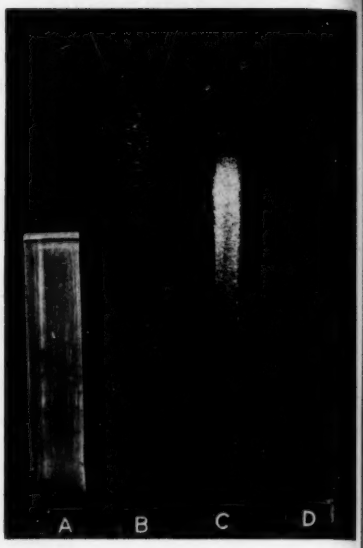

Fig 5.—Crazed tensile specimens of polymethyl methacrylate. A: Unstretched; crazed during short-time tensile test. B: Unstretched; stress-solvent crazed with benzene; maximum stress 2400 p.s.i. C: Biaxially stretched 100%; stress-solvent crazed with benzene; maximum stress 7000 p.s.i. D: Biaxially stretched 150%; stress solvent crazed with benzene; maximum stress 10,000 p.s.i.

Fig. 3 (above)—Top view of fracture surfaces of heat-resistant acrylic tensile specimens with varying degrees of biaxial stretching. Note mirror areas in lower right hand corner of stretched and in center of bottom of unstretched specimen. Fig. 4 (below)—Side view of fracture surfaces of polymethyl methacrylate tensile specimens which have been exposed to varying degrees of biaxial stretching

210 and 160% higher than for the unstretched general-purpose and heat-resistant grades, respectively, corresponding to approximately three-fourths and two-thirds of the respective ultimate strengths. Most of the specimens of the more highly stretched materials did not craze upon the application of benzene even at stresses very close to the ultimate strength.

Several stress-solvent-crazed specimens are shown in Fig. 5, along with a stress-crazed specimen. The craze cracks in the 100% stretched solvent-crazed specimen are finer and more numerous than in the unstretched solvent-crazed specimen. This same effect was noted for the 50% stretched specimens.

The results of the abrasion tests are shown in Table III*. The light transmission of the formed specimens after abrasion was only slightly less than that of the unformed specimens. The haze of the formed material after abrasion, however, was appreciably higher than that of the unformed material in every case, this increase ranging from approximately

* Tables II and III appear on p. 134.

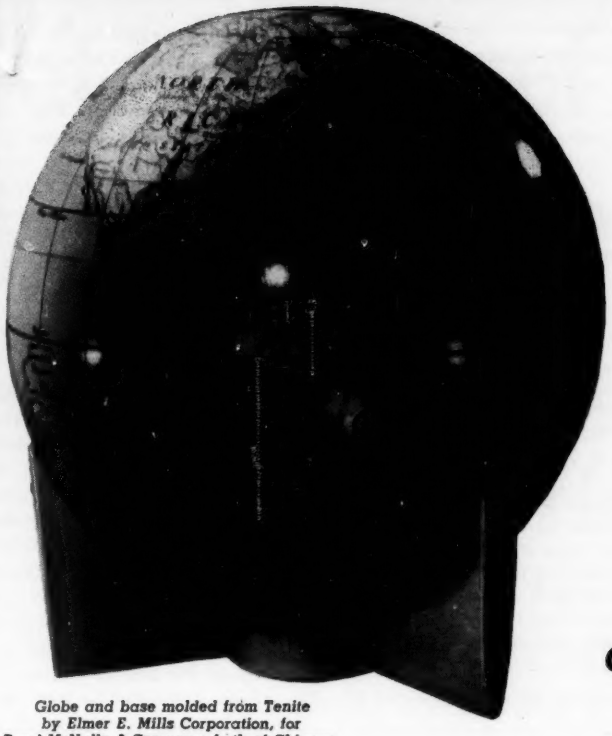

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Table II—Effect of Biaxial Stretching on Stress-Solvent Crazing with Benzene of Polymethyl Methacrylate at 23° C.[a]

Material	*Biaxial stretch*	*Threshold-crazing stress*
	%	p.s.i.
	Unstretched	
Lucite HC201	—	1760 ± 30
Lucite HC202	—	2450 ± 40
Plexiglas I-A	—	1710 ± 30
Plexiglas II	—	2760 ± 70
	Stretched	
Lucite HC201	100	5520 30[b]
Lucite HC202	100	6260 300[b]
Lucite HC201	145	Two specimens crazed very slightly at stress of 7050 p.s.i. Six specimens did not craze at stresses of 7450 to 7750 p.s.i.
Lucite HC202	150	Six specimens crazed slightly at stresses of 6700 to 9150 p.s.i. Two specimens did not craze at stress of 9700 p.s.i.
Plexiglas I-A	170	Seven specimens did not craze at stresses of 8425 to 8650 p.s.i.
Plexiglas II	165	One specimen crazed very slightly at stress of 9800 p.s.i. Six others did not craze at stresses of 9700 to 10,000 p.s.i.

[a]All results are the average for eight specimens, unless otherwise noted, plus or minus the standard error. [b]Average of four specimens tested.

Table III—Effect of Biaxial Stretching on Surface Abrasion of Polymethyl Methacrylate at 23° C.[a]

Material	*Biaxial stretch*	*Light transmission*		*Haze*	
		Original	*Final*	*Original*	*Final*
	%	%	%	%	%
Plexiglas I-A	0	92.2 ± 0	84.7 ± 0.3	0.2 ± 0	29.6 ± 1.3
	160	91.8 ± 0.1	83.8 ± 0.1	0.4 ± 0	42.8 ± 0.4
Plexiglas II	0	92.3 ± 0	86.3 ± 0.1	0.2 ± 0.1	22.2 ± 0.3
	160	91.8 ± 0.1	84.8 ± 0.3	0.4 ± 0.1	31.1 ± 1.2
	0	92.0 ± 0	87.1 ± 0.3	0.3 ± 0	23.3 ± 1.0
	56	92.0 ± 0	85.3 ± 0.6	0.4 ± 0	28.1 ± 1.8
	115	92.1 ± 0	84.2 ± 0.9	0.3 ± 0	36.4 ± 5.3
Lucite HC202	0	92.1 ± 0.1	87.1 ± 0.1	0.5 ± 0.1	23.7 ± 0.2
	70	92.1 ± 0	85.6 ± 0.3	0.1 ± 0.1	28.8 ± 0.5
	100	92.0 ± 0.1	85.7 ± 0.1	0.2 ± 0	27.3 ± 0.1

[a]All results are the average for three specimens from the same disk, plus or minus the standard error. The specimens in each group of tests were taken from the same sheet of material. Final measurements were taken after 250 revolutions of the abraser.

15 to 55 percent. From the data there is a rough indication of increase in haze after surface abrasion with higher degrees of stretching. This was also apparent in working with specimens of the stretched material. The highly stretched tensile specimens were easily scratched when rubbed gently with industrial cleansing tissues or absorbent cotton, which was not true when the same treatment was applied to specimens having low degrees of stretching.

X-ray diffraction patterns were obtained on both stretched and unstretched polymethyl methacrylate, using a recording Geiger counter spectrometer with a copper target and nickel filter. The patterns were similar to those obtained by Krimm and Tobolsky (5), with halos at Bragg spacings of 6.5 and 3.0 A. for both the unstretched and the stretched materials, compared with 6.60 and 2.92 A. reported by the above authors. They attribute the former spacing to interchain interferences and the latter to intramolecular interferences. The height of the 6.5 A. peak was approximately 30% higher for the stretched material than for unstretched. This would indicate increased orientation in the stretched polymer, which is expected from the nature of the stretching operation. There was a slight decrease noted in height of the 3.0 A. peak of the stretched samples, but it is of questionable significance.

Mechanism of Crazing

The mechanism of crazing has been discussed in a previous report (1). It was postulated that crazing starts at the surface at submicroscopic flaws or weak points. Such weak points may be submicroscopic regions in which the polymer chain-segments are oriented normal to the applied stress. In biaxial stretching, the chain segments turn into a position more nearly parallel to the surface, and this angular change is dependent on the degree of stretching. The chain segments do not, on the average, change the angle of their projections on the plane of the sheet with respect to the length or width of the sheet. Bailey (6) previously made similar statements for polymer chains. As the orientation increases, it may become more difficult for a submicroscopic crack to propagate through the thickness of the sheet, because of the development of "cleavage" planes (1). The possibility then exists that, in highly formed polymethyl methacrylate, submicroscopic cracks form on the surface of a specimen when a tensile load is applied. The growth of cracks through the sheet is retarded by the planar orientation, however, and the specimen fails before the cracks become visible.

Crazing may be local tensile failure resulting from internal stresses, as postulated by Russell (7), or may result from other types of surface flaws or defects, which would be points of localized stress concentration. These flaws might be inhomogeneities in chemical composition, such as residual catalyst, or physical surface defects resulting from the casting operation. The importance of flaws in effecting the fracture of other materials has been recognized. Griffith (8) has proposed a theory of the strength of glass based on the presence of surface cracks. The importance of structural

(*Continued on p. 204*)

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PLASTICS DIGEST*

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. Send requests for periodicals to the publishers listed.

Materials

CURING OF EPOXIDE RESINS. E. S. Narracott. Brit. Plastics *26*, 120-22 (Apr. 1953). The chemistry of the curing of epoxide resins by amine curing agents is discussed in detail. Reaction of epoxides with primary, secondary, and tertiary amines are considered. The results indicate that the primary amines themselves do not give rise to cross-linked chains and that cure may be accomplished by the secondary or tertiary amines. Also the curing involves the hydroxyl groups present in the epoxide resin and the presence of epoxy groups may, in fact, merely cause consumption of some of the effective curing agent to form esters groups.

HYDROGENATED SYNTHETIC ELASTOMERS. R. V. Jones, C. W. Moberly, and W. B. Reynolds. Ind. Eng. Chem. *45*, 1117-22 (May 1953). It is shown that the hydrogenation of synthetic elastomers, such as polybutadiene and copolymers of butadiene with various vinyl compounds, produces a group of thermoplastic resins possessing interesting properties. These materials resemble polyethylene but are generally more flexible, particularly at very low temperatures. For example, hydrogenated polybutadiene can be struck sharply at —100°F. without shattering and is not brittle (even though extremely hard) at liquid nitrogen temperatures. Hydrogenation can be carried to various stages, depending upon the properties desired. For most plastic applications, an unsaturation of 5 to 30% of the original is desirable. Higher unsaturations increase the ability of the products to undergo vulcanization. Some of the more important potential applications for hydrogenated polymers are in wire and cable coating, films, tubing, and various molded items.

INDUCTION HEATING FOR SYNTHETIC RESIN PLANT. O. Lenhard. Plastics (London) *18*, 21-22 (Jan. 1953). Induction heating systems are described and their advantages over other heating systems in the production of synthetic resins are discussed. It is concluded that this new form of heating will take a prominent place in this industry.

NEW UREA-FORMALDEHYDE RESINS FOR PAPER PRODUCTS. A. Petz. Kunststoffe *43*, 103-105 (Mar. 1953). Water-soluble urea resins which lose their hardening properties to a large degree have been developed and improved. They represent new fully synthetic and cheap adhesives which are used in gummed labels, in the packaging industry, and in similar applications. Tables and graphs show that the properties of these new adhesives depend on the chemical properties of the resin, concentration, time, and temperature.

Molding and Fabricating

COMPOUNDING AND PROCESSING RIGID POLYVINYL CHLORIDE. R. J. Ettinger. SPE J. *9*, 16-21 (Feb. 1953). The formulation of rigid polyvinyl chloride plastics is described. This includes detailed information on stabilizers, plasticizers when used, fillers, lubricants, colors, and the techniques for processing. The techniques for calendering, extruding, compression molding, transfer molding, and injection molding are also described in detail.

FACTORS AFFECTING THE HIGH-SPEED TAPPING OF PLASTICS. W. M. Halliday. Flastics (London) *18*, 64 (Feb. 1953). Operating factors involved in the tapping of plastics materials are discussed and safeguarding precautions described. Results of certain practical tests to ascertain comparative cutting merits and durability of various kinds of taps are given.

RELIEVING STRESSES IN POLYSTYRENE BY HEAT TREATMENT. E. E. Halls. Plastics (London) *18*, 81 (Mar. 1953). Polystyrene may contain residual stresses from the casting or extruding operation, or from machining. These stresses often lead to cracking and subsequent failure. To alleviate this condition, it is recommended that polystyrene stock be heat treated before, and the components after, machining. The heat treatment for stress relieving needs to be as close to the critical temperature of melting as practical, and a temperature of 170° F. is suggested. Slow cooling is essential. The same kind of treatment applies to moldings if they are subjected to any machining operations. Trouble experienced with moldings in the "as molded" condition is probably associated with faulty technique in the molding process.

PROGRESS IN EXTRUSION. Plastics (London) *18*, 139-41 (May 1953). Developments in the field of plastic extrusion and extrusion equipment are described.

Applications

MOLDED POLYTHENE SHEET FOR SURGICAL APPLIANCES. Brit. Plastics *26*, 87-89 (Mar. 1953). The application and production of polythene surgical appliances is discussed. Polythene is especially suited for immobilizing joints. The polythene sheet, while hot, is placed over a mold made from a plaster cast of the joint or injured area. It is then cooled, stripped off, finished by trimming and buffing, and air holes are drilled to allow the body part to breathe.

PLASTICS IN THE FOOD INDUSTRY. Brit. Plastics *26*, 112-17 (Apr. 1953). Some of the lesser known applications of plastics in the food industry are described. An increasing quantity of plastics is being used in the processing and preparation of food. Typical of such behind-the-scenes applications of plastics are plastic laminated linings, polyvinyl chloride coated conveyor belts, polyvinyl chloride and polyethylene piping, polyethylene jugs, and acrylic plastic weights and measures.

A NEW APPLICATION OF PLASTICS TO PRINTING. Plastics (London) *18*, 76-77 (Mar. 1953). A new method is described using polystyrene type powder instead of paper in preparing an overlay for use in the halftone process of photographic reproduction in printing. This process effects considerable saving in time in the preparation of the overlay and at the same time improves the printed product;

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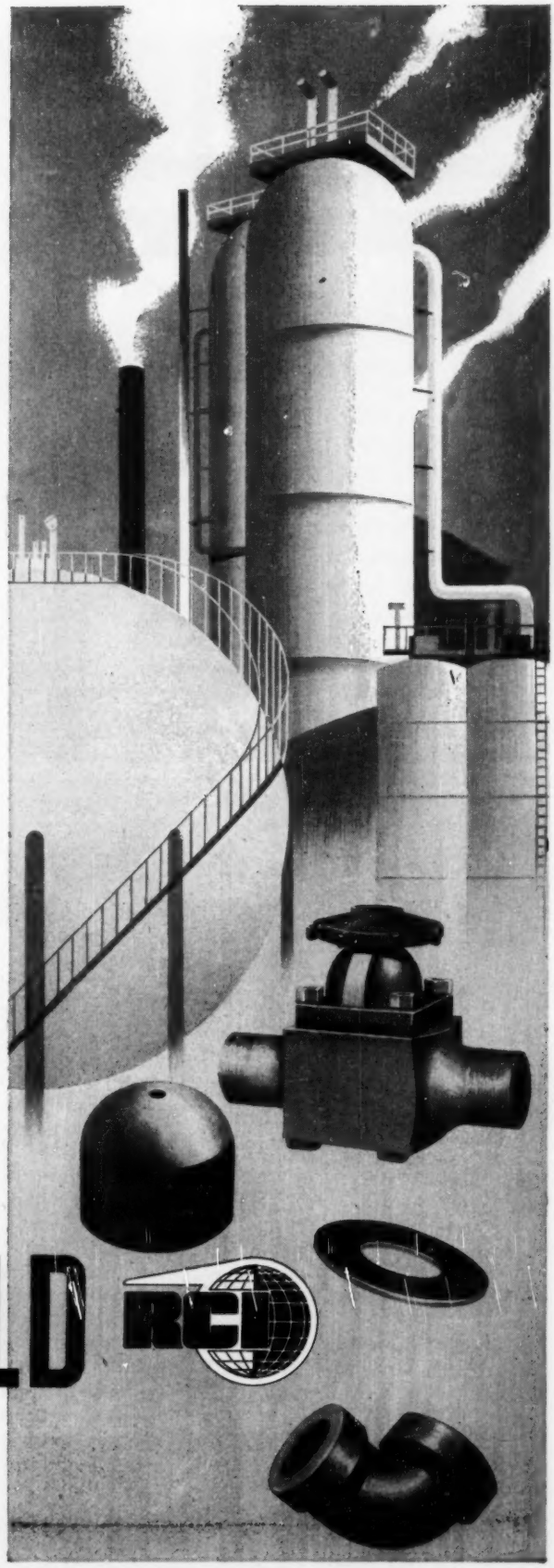

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Properties

APPARATUS FOR MEASURING GAS PERMEABILITY OF SHEET MATERIALS. D. W. Brubaker and K. Kammermeyer. Analytical Chem. *25*, 424-6 (Mar. 1953). An apparatus and procedure for determining the gas permeabilities of sheet materials, including plastic sheet and films, are presented. The operation of the apparatus is based upon the principle of measuring a change in volume at conditions of constant pressure and temperature. The apparatus is relatively simple and is of a positive pressure type with the low pressure side being at approximately atmospheric pressure. Typical results are given for polyethylene, trithene, and polyvinyl chloride for helium and hydrogen gas.

PLASTICS: THEIR MECHANICAL BEHAVIOR AND TESTING. W. N. Findley. Applied Mechanics Rev. *6*, 49–53 (Feb. 1953). The literature on the mechanical behavior of plastics is reviewed. Stress-strain characteristics, static strength, ductility, brittleness, damping, dynamic modulus, fatigue, creep, stress relaxation, relation between static tests and creep tests, residual stresses, crazing, fracture, and contact friction are considered.

REPORT ON MOLECULAR-WEIGHT MEASUREMENTS OF STANDARD POLYSTYRENE SAMPLES. International Union of Pure and Applied Chemistry. J. Polymer Sci. *10*, 129–48 (Feb. 1953). Four polystyrene samples were investigated in numerous laboratories by means of viscosimetry, osmometry, light scattering, and ultracentrifugation. The various results are compared and critically discussed. Possible explanations and suggestions for improvement are offered in those cases where considerable discrepancies occur. The results of viscosimetry and osmometry in general do not give satisfactory agreement whereas the light-scattering data, particularly in the high-molecular-weight range, and the few available ultracentrifugal results agree quite satisfactorily.

SUPPLEMENT TO MECHANICAL PROPERTIES OF PLASTIC LAMINATES. F. Werren. U. S. Dept. Agr. Forest Products Lab. Rept. No. 1820-A (Feb. 1953). The results of tension, compression, bending, and shear tests of six parallel-laminated glass-fabric-base plastics laminates are reported. The data supplement those of a previous report of the same title, Forest Products Laboratory Report No. 1820, in which results of tests of 14 laminates were given. Tests of the laminates were made after both normal and wet conditioning. The mechanical properties of the laminates, both dry and wet, are presented in the form of tables and by average stress-strain curves.

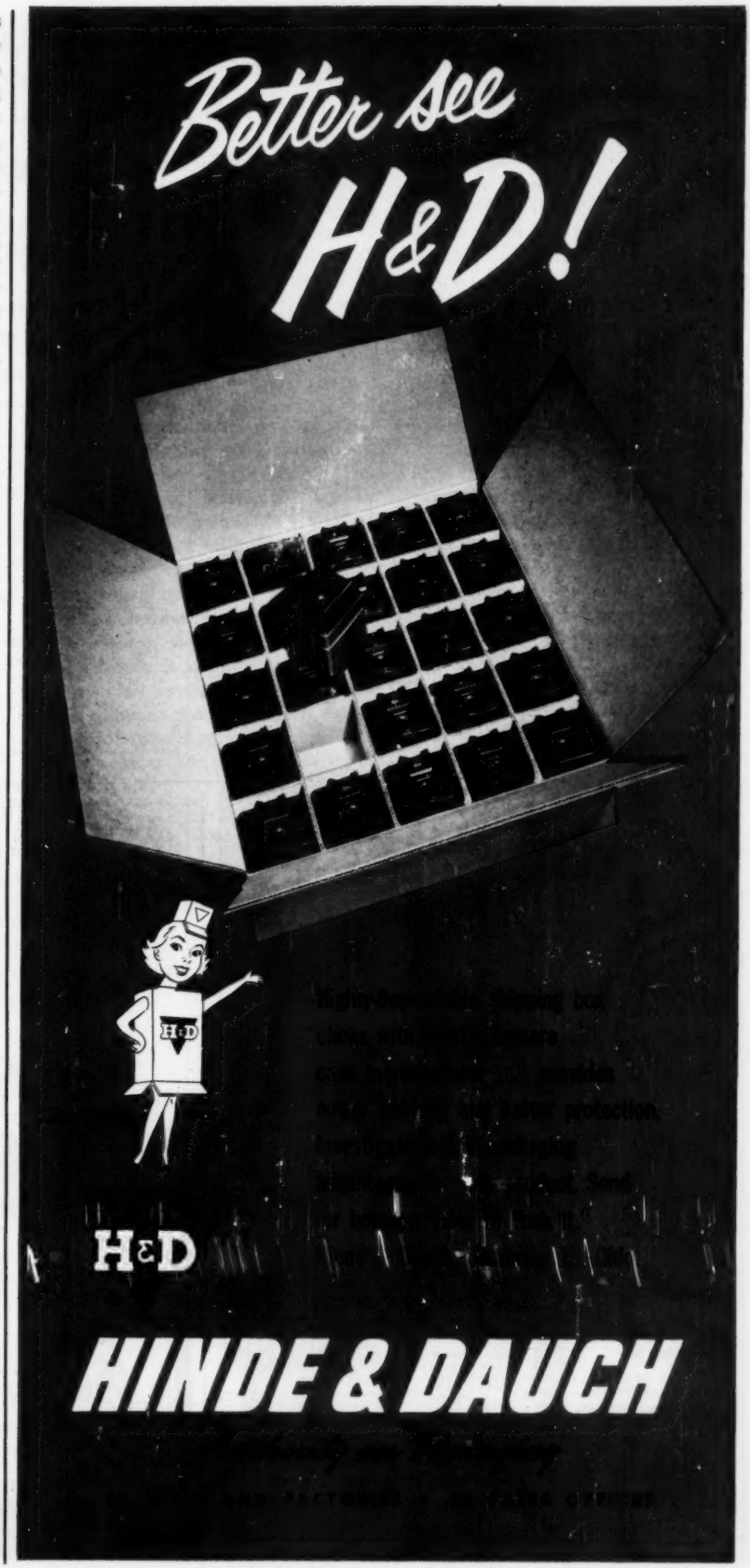
Testing

CONDITIONING AND WEATHERING OF ADHESIVES AND PLASTICS. F. W. Reinhart. A.S.T.M. Special Tech. Pub. No. 133: Symposium on Conditioning and Weathering, pp. 42–51 (June 24, 1952). Special conditioning is often required in the handling of adhesives and the processing of plastics. Tests to determine these conditions are straightforward and offer no particular problem to technologists. This phase is not subject to standardization. Conditioning for and during

testing of adhesives and plastics is necessary in the evaluation of the results and to obtain comparable results. The conditions are fairly well standardized and correlated as evidenced by the work of the A.S.T.M. and the Federal Specifications Technical Committees. Further standardization is needed in accelerated service tests; some of this work, particularly on adhesives, is under way. The principal faults in these tests are a) variability in service conditions, b) inaccurate knowledge of service conditions, c) distortions caused by using more strenuous laboratory test conditions to obtain acceleration and differences in concentration of degradation products in the materials. With factors such as these, a high degree of correlation between accelerated laboratory tests and behavior in service is not to be expected except in rare instances, although reasonably good correlation has been obtained in some cases. Experience in interpreting the results of the accelerated laboratory tests is one key to the problem. Accelerated weathering testing is in an unsatisfactory state. The degree of correlation between laboratory tests and behavior on exposure is far from satisfactory. This lack of correlation is attributed to a) the greater variability in outdoor weather, b) variability in laboratory accelerated weathering test equipment, c) distortions caused by using greater light intensities, higher temperatures, different moisture conditions, and more prolonged periods of these conditions to obtain acceleration in the laboratory test, and d) the resulting increased concentration of degradation products.

Chemistry

POLYMERIZATION IN BULK AT HIGH PRESSURES. K. H. Klaassens and J. H. Gisolf. J. Polymer Sci. *10*, 149-55 (Feb. 1953). An apparatus is described for polymerizing monomers in bulk up to a pressure of 10,000 atm. and in which the polymerizing substance can be heated and the temperature of the substance measured. Styrene shows an explosive reaction at 10,000 atm. and about 70° C. Indene polymerizes slowly and shows an explosive reaction at 175° C. Both compounds give a solid polymer. Crotonaldehyde gives a brittle, high-melting polymer. Coumarone and some chlorinated ethy-



lenes carbonize. Butyraldehyde polymerizes to a solid product which rapidly reverts to butyraldehyde.

COPOLYMERIZATION OF VINYL ACETATE WITH SOME LONG-CHAIN VINYL ESTERS. W. S. Port, E. F Jordan, Jr., J. E. Hansen, and D. Swern. J. Polymer Sci. *9*, 493–502 (Dec. 1952). A study was made of the copolymerization of vinyl acetate with vinyl palmitate, vinyl stearate, and vinyl oleate, respectively. True copolymerization was shown to have occurred on the basis of the solubility characteristics of the crude copolymers over a wide range of compositions. The monomer reactivity ratios for the comonomers vinyl palmitate (r_1) and vinyl acetate (r_2) were determined by two methods. One, based on an analysis of the copolymer, gave $r_1 = 0.78 \pm 0.10$ and $r_2 = 1.15 \pm 0.13$; the other, based on an analysis for each monomer in the mixture remaining after polymerization, gave $r_1 = 0.66 \pm 0.07$ and $r_2 = 0.84 \pm 0.10$. When the vinyl palmitate or vinyl stearate content of the copolymer exceeded about 20-25 mole %, the copolymers exhibited first-order transition points which were determined using a refractive index technique as well as a polarizing microscope method. Where no transition point could be observed, brittle point was measured.

Coatings

VINYL-TYPE POLYMERS IN SURFACE COATINGS. W. A. Edwards. Plastics (London) *18*, 86-7, 91 (Mar. 1953). During the last six years, a number of thermoplastic vinyl-type polymers have become firmly established as resins for use in surface coatings. The special technical qualities of finishes produced are discussed, as well as some of the present uses of these coatings. The resins discussed are polyvinyl butyral, polyvinyl acetate, vinyl acetate-chloride copolymers, polystyrene, copolymers of styrene with drying oils, and methacrylic esters. The main application of polyvinyl butyral has been in the preparation of etching primers for ensuring good paint adhesion to difficult surfaces. These primers are now being used to a considerable extent particularly on light metal alloys where they are showing signs of becoming the counterpart of phosphate treatment for steel articles prior to painting. Straight polymers of vinyl acetate are not entirely suitable for the preparation of varnishes or lacquers but are now commonly used as ingredients of decorative emulsion finishes which are proving increasingly popular. The solubility characteristics of polyvinyl chloride alone are not those desirable for a varnish ingredient, so that the copolymers of the acetate and the chloride have been developed in which the useful properties of both materials are combined in their optimum proportions. The three principal uses for these resins are in stripping lacquers, anti-corrosive enamels, and stoving lacquers. Polystyrene itself is in only limited use in the varnish industry at the present time, the most spectacular outlet being as an important constituent of "zinc-rich" priming paints for steel work. By copolymerizing styrene and alpha-methylstyrene in the presence of various drying oils, varnishes of novel properties are produced, having low acidity, good speed of drying and excellent durability and gloss retention. The methacrylic esters have found a number of special purpose uses.

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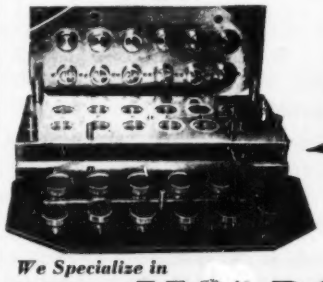

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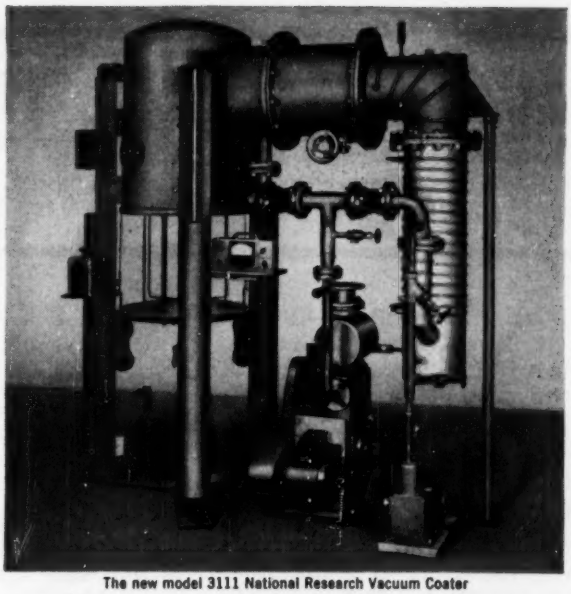

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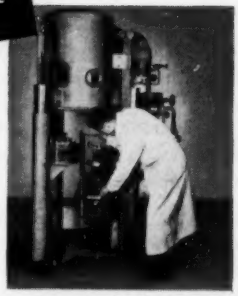

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U. S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D.C., at 25¢ each.

MATTING AGENTS. H. S. Lilley and J. K. Lovell (to Imperial Chemical Ind.). U.S. 2,636,868, Apr. 28. Phenolic resin-rosin salt composition.

MOLDING COMPOSITIONS. D. A. de Tartas (to Radio Corp. of America). U.S. 2,636,869, Apr. 28. Polyvinyl chloride composition.

NON-BLOCKING. H. E. Connors and A. L. Hatfield (to B. F. Goodrich). U.S. 2,636,870, Apr. 28. Non-blocking dispersions.

DISPERSIONS. R. W. James and D. W. Lovering (to Arthur D. Little). U.S. 2,636,871-2, Apr. 28. Polyvinyl chloride dispersions.

BLENDS. B. Graham (to Du Pont). U.S. 2,636,873, Apr. 28. Blends of polyamides and polymeric polyamines.

RESINS. R. A. Gregg (to U.S. Rubber). U.S. 2,636,874, Apr. 28. Halogen-containing resins from 2-alkenoxyalkyl esters and bromomethanes.

RESINS. H. Zenftman and A. McLean (to Imperial Chemical Ind.). U.S. 2,636,876, Apr. 28. Resinous aromatic polyphosphates.

POLYMERIZATION. D. Coleman (to Imperial Chemical Ind.). U.S. 2,636,877, Apr. 28. Polymerization of anhydro - N - carboxy - alpha - amino acids.

CELLULOSE ETHERS. W. M. Branan, L. A. Burrows, and B. H. Mackey (to Du Pont). U.S. 2,636,879, Apr. 28. Manufacture of sodium carboxymethyl cellulose.

SILOXANES. L. W. Frost (to Westinghouse). U.S. 2,636,896, Apr. 28. Organosiloxanes containing trifluoromethylphenyl groups.

VINYL POLYMERS. L. M. Germain (to Shawinigan Chemicals). U.S. 2,637,119, May 5. Drying granular vinyl ester polymers.

DISPERSIONS. M. H. M. Arnold (to Postans). U.S. 2,637,534-5, May 5. Preparing dispersions with ultrasonic vibrations.

RESINS. W. O. Dawson and L. Sellet (to Jacques Wolf). U.S. 2,637,622, May 5. Formaldehyde-dicyandiamide resins for treating leather.

COATED FABRIC. R. H. Barnard (to Reconstruction Finance). U.S. 2,637,673, May 5. Non-woven film-coated fabric.

CONDENSATES. F. R. Hurley (to Monsanto). U.S. 2,637,704, May 5. Condensate of polymeric phosphonitrilic chloride, chloro-aniline, and a polyamino compound.

ADHESIVES. M. A. Bergstedt and R. H. Lamason (to Industrial Tape). U.S. 2,637,706, May 5. Adhesives of phenol-formaldehyde resins, polyvinyl acetal resins, and ricinoleate esters.

RESINS. P. E. Marling and A. R. Hempel (to Monsanto). U.S. 2,637,707-8, May 5. Oil-modified, alkyd resins from soybean oil and monopentaerythritol.

RESINS. M. T. Harvey (to Harvel). U.S. 2,637,709, May 5. Reacting cashew nut shell liquid and polymers with unsaturated fatty acids.

ADHESIVES. G. E. Hulse (to Hercules). U.S. 2,637,710, May 5. Adhesive of methyl isopropenyl ketone-butadiene copolymer.

COPOLYMERS. W. V. Upton (to National Starch). U.S. 2,637,712, May 5. Copolymers of vinyl acetate with derivatives of alpha-beta-unsaturated dicarboxylic acids.

RESIN. T. J. Suen and A. M. Schiller (to American Cyanamid). U.S. 2,637,713, May 5. Urea-formaldehyde resin modified with an epihalohydrin.

RESIN. W. S. Emerson and R. I. Longley (to Monsanto). U.S. 2,637,714, May 5. Polyvinyl halide plasticized with diethylene glycol esters.

RESIN. G. H. Ott (to Ciba). U.S. 2,637,715-6, May 5. Epoxy-resin-polycarboxylic acid-dicyandiamide reaction products.

POLYMERS. C. H. Basdekis (to Chemstrand). U.S. 2,637,717, May 5. Blends of acrylonitrile with other polymers.

COPOLYMERS. J. B. Rust (to Montclair Research and Ellis-Foster). U.S. 2,637,718, May 5. Copolymers containing hydrogen bonded to silicon.

SILOXANE. J. E. Dereich (to Diamond Alkali). U.S. 2,637,719, May 5. Siloxane compositions.

POLYMERIZATION. H. G. Schneider and P. W. Brakeley, Jr. (to Standard Oil). U.S. 2,637,720, May 5. Polymerizing isobutylene in the presence of n-butenes and ether.

COPOLYMER. E. W. Gluensenkamp and G. E. Ham (to Chemstrand). U.S. 2,637,721, May 5. Fiber-forming acrylonitrile copolymers.

ADHESIVE. L. A. Brooks (to R. T. Vanderbilt). U.S. 2,637,751, May 5. Adhesives of chlorinated and hypochlorinated rubber.

MIXTURES. A. C. H. Weiss. U.S. 2,637,915, May 12. Apparatus for removing moisture from a mixture of Kraft pulp and resin.

CARTON. W. J. Poole (to Container Corp.). U.S. 2,638,261, May 12. Plastic lid for freezer carton.

ABRASIVE. N. P. Robie (to Electro Refractories). U.S. 2,638,413, May 12. Abrasive article containing phenolic resin.

PHOTOGRAPHIC FILM. C. F. A. White and J. R. Hill (to du Pont). U.S. 2,638,417, May 12. Cellulose derivative stripping layers.

COPOLYMERS. D. W. Young, W. H. Smyers, and W. J. Sparks (to Standard Oil). U.S. 2,638,445, May 12. Sulfonated styrene-defin copolymers.

PLASTIC. E. R. Laning (to Stokes Molded Products). U.S. 2,638,456, May 12. Plastic mixture of butadiene-styrene copolymer and anthracite coal.

RESINS. D. H. Wheeler (to General Mills). U.S. 2,638,458, May 12. Hydrogenated phenolic resin esters.

POLYMERS. W. O. Ney, Jr., W. R. Nummy, and C. E. Barnes (to Ar-

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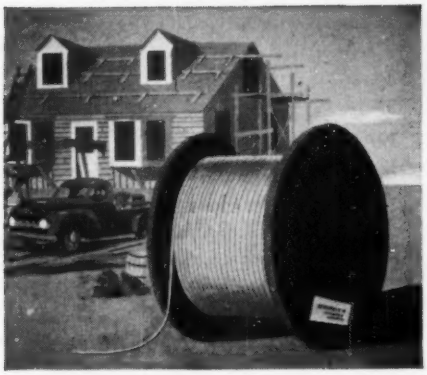

DESCRIPTIVE DATA

CELANESE PLASTICIZER	GRADE	APPEARANCE	COLOR APHA Max.	SPECIFIC GRAVITY @ 20/20°C.	ACIDITY	ESTER VALUE % Min.	PERMANGANATE TIME, Min. (in Minutes)	REFRACTIVE INDEX @ $n\frac{25°C.}{D}$
LINDOL* tricresyl phosphate coal tar base	Technical	Clear transparent liquid	75	1.165 ± .005	0.01 (2)	99	30	1.553
CELLUFLEX* 112 a mixed ester	Technical	Clear transparent liquid	40	1.210 ± .005	0.01 (2)	99	30	1.560
CELLUFLEX* 179C tricresyl phosphate petroleum base	Technical	Clear transparent liquid	150	1.165 ± .005	0.01 (2)	99	30	1.553
CELLUFLEX* TPP triphenyl phosphate	Technical	White flakes	20	—	0.003 (3)	99	30	[illegible]
CELLUFLEX* DBP dibutyl phthalate	Technical	Clear transparent liquid	50	1.045 ± .001	0.01 (2)	98	—	1.490
CELLUFLEX* DOP dioctyl phthalate	Technical	Clear transparent liquid	50	0.986 ± .002	0.01 (2)	98	—	1.485

(1) @ 60°C. (2) % as phthalic, max. (3) % as phosphoric, max.

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nold, Hoffman). U.S. 2,638,463, May 12. Polypyrrolidone.

POLYMERIZATION. W. B. Reynolds, J. E. Wicklatz, and T. J. Kennedy (to Phillips Petroleum). U.S. 2,638,464, May 12. Polymerization of vinyl lidene compounds in the presence of dimethyhalophenyl hydroperoxy methane.

COPOLYMERS. J. L. Amos and C. T. Miller (to Dow). U.S. 2,638,465-6, May 12. Copolymers of styrene and alpha methyl styrene.

BONDING. L. C. Rubin (to M. W. Kellogg). U.S. 2,638,523, May 12. Bonding trifluorochloroethylene to metal.

STRIPSTOCK. L. L. Stott and P. L. Shurr (to Polymer). U.S. 2,638,628-31, May 19. Production of polyamide strip stock.

HEAT SEALING. E. J. Andina (to Amsco Packaging Machinery). U.S. 2,638,964, May 19. Heat-sealing thermoplastic materials.

GRANULATOR. I. Hinerfeld. U.S. 2,-639,096, May 19. Apparatus for granulating plastic materials.

MOISTUREPROOF SHEET. R. T. K. Cornwell (to American Viscose). U.S. 2,639,241, May 19. Regenerated cellulose sheet coated with urea resin and a thermoplastic resin.

LAMINATE. T. S. Reese (to Di-Noc). U.S. 2,639,253, May 19. Melamine resin-impregnated paper transfer layer for decorative laminates.

RESIN ARTICLES. C. G. Evans and A. Baker (to United Kingdom). U.S. 2,639,258, May 19. Reinforced resin articles containing phenolic and resorcinol resins.

RESINS. G. A. Griess and C. V. Strandskov (to Dow). U.S. 2,639,270-1-2, May 19. Styrene-modified alkyd resins.

COPOLYMERS. C. W. Gould (to Hercules). U.S. 2,639,273, May 19. Copolymers of allyl esters of stabilized rosin acids.

RESIN. R. A. Salathiel (to Standard Oil). U.S. 2,639,274, May 19. Sulfonated phenolic resins.

POLYMERIZATION. H. H. Vickers and S. E. Jaros (to Standard Oil). U.S. 2,639,275, May 19. Preparation of oil solutions of high molecular weight polymers.

SILOXANES. R. Smith-Johannsen and C. S. Oliver (to General Electric). U.S. 2,639,276, May 19. Organopolysiloxanes containing peroxides and titanium dioxide.

RESINS. A. A. Varela (to American Cyanamid). U.S. 2,639,277, May 19. Melamine resin with china clay filler.

NYLON. L. L. Stott and L. R. B. Hervey (to Polymer). U.S. 2,639,278, May 19. Preparation of finely divided nylon.

POLYMERIZATION. J. R. Caldwell (to Eastman Kodak). U.S. 2,639,279, May 19. Solution polymerization in aqueous solutions of aromatic sulfonates.

CARBOXYMETHYL CELLULOSE. A. Hodge, J. G. Napier, and J. Downing (to British Celanese). U.S. 2,639,281, May 19. Manufacture of carboxymethyl cellulose.

MOLDING. J. H. Green and W. Makenny (to Westinghouse). U.S. 2,-639,465, May 26. Automatic multicavity molding with dielectric preheat.

PACKAGING. A. W. Barry and F. S. Chance, Jr. (to du Pont). U.S. 2,639,-808, May 26. Tacky chloro-sulfonated polyethylene enveloped in a film of vinyl acetate-ethylene copolymer.

POLYVINYL ALCOHOL. T. Tomonari (to Omni Products). U.S. 2,639,970, May 26. Treatment of polyvinyl alcohol fibers with dielectric heat.

POLYETHYLENE. A. A. Pavlic (to du Pont). U.S. 2,639,998, May 26. Applying ink to surfaces of polyethylene.

RESINS. J. C. Williams (to Hawley Products). U.S. 2,640,039, May 26. Vinyl acetate-maleic anhydride copolymers.

RESINS. W. M. Bruner and H. M. Kvalnes (to du Pont). U.S. 2,640,041, May 26. Preparation of melamine-aldehyde resins.

COPOLYMER. L. H. Howland and V. S. Chambers (to U.S. Rubber). U.S. 2,640,042, May 26. Butadiene-vinyl pyridene copolymer.

RESINS. R. H. Sturm (to Cosmocord Plastics). U.S. 2,640,043, May 26. Phenol-aldehyde-ketone resins.

POLYAMIDES. G. S. Stamatoff (to du Pont). U.S. 2,640,044, May 26. Heat stabilizing polyamides with phosphorus compounds.

RESINS. J. McDonald (to Westinghouse). U.S. 2,640,045, May 26. Phenol-furfural resins.

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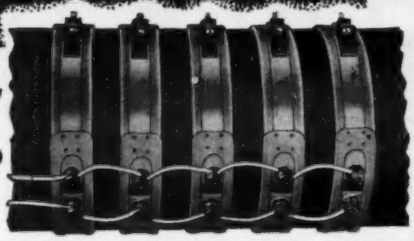

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NEW MACHINERY AND EQUIPMENT

SINGLE STAGE PRE-PLASTICIZER—A new pre-plasticizing injection molding machine has been introduced by R. H. Windsor Ltd., Leatherhead Road, South Chessington, Surrey, Eng. It is known as the A.P. 1044 Autoplas single stage multi-screw pre-plasticizer unit.

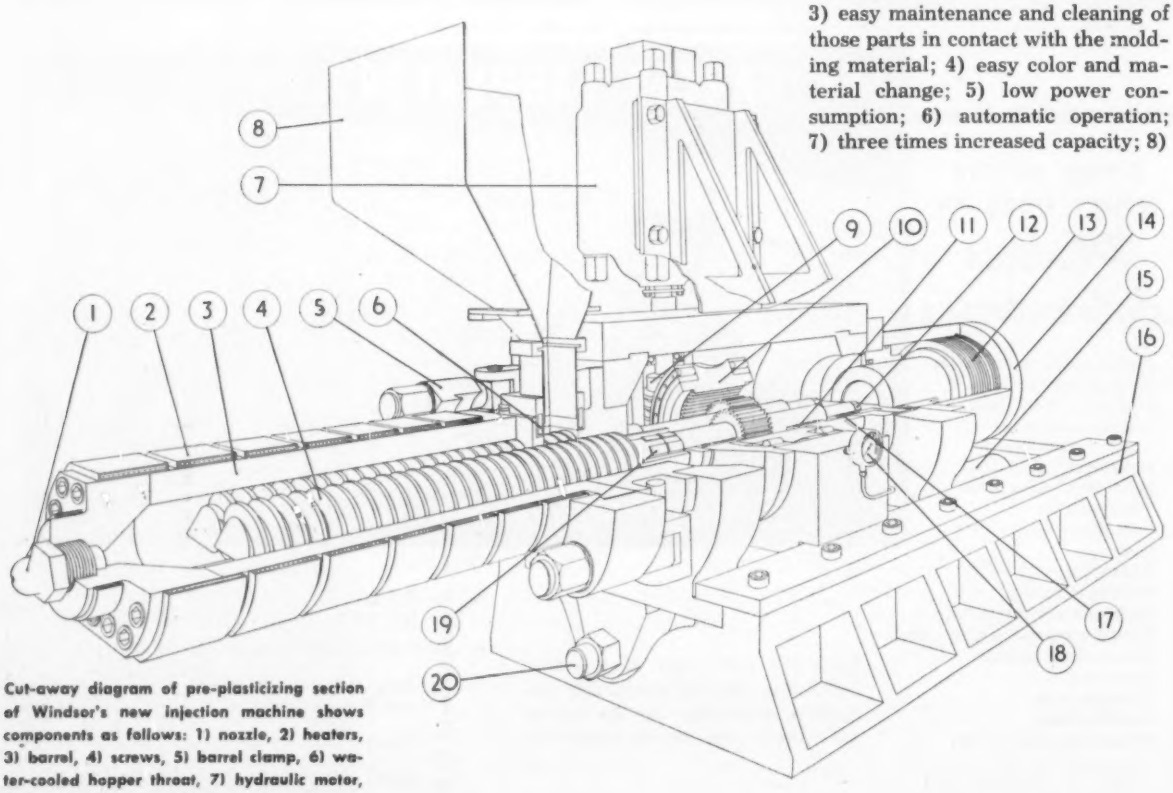
The new machine presents for the first time a single stage "in-line" system of pre-plasticizing. The incorporation of this unit into the Windsor SH 8/10-oz. injection molding machine enables 32-oz. moldings to be made, whereas the previous maximum capacity of the machine was only 10 ounces. Plasticizing capacity, which formerly was about 60 lbs., is now raised to about 140 pounds.

The novel injection plunger consists of two specially designed intermeshing screws which are driven by a fluid motor through a gear box. The fluid motor, gear box, and screw assembly slide forward and backward as an independent unit. The material is fed to a heated stationary barrel, in which the screws rotate, and press the plastic mass forward, plasticizing it under high pressure, to the front of the barrel.

Injection is accomplished by a hydraulic ram, the cylinder of which is fixed at the far end of the frame. The ram moves the screws (which do not rotate during injection) forward through the barrel towards the nozzle, expelling the pre-plasticized material into the mold.

When the mold is filled, the fluid motor starts and the screws resume rotation, pressing the plasticized material forward and filling the front of the barrel. Since the mold is already filled, pressure is built up in front of the screws, causing the screws, gear box, fluid motor assembly, and the hydraulic ram to move backward to a predetermined stop. The return movement can be arrested at any point of the stroke. As the movement is relevant to the weight of shot required, it can, if necessary, be actuated to serve the same conditions as the "weigh-in" method. During this movement, cooling of the molded component has taken place and it can be removed. The mold is then closed and the cycle begins again.

In addition to greatly increased capacity, advantages claimed for this development include: 1) single stage auto-plasticizer with only one movement instead of two; 2) clean plasticizing without trace of bleedback; 3) easy maintenance and cleaning of those parts in contact with the molding material; 4) easy color and material change; 5) low power consumption; 6) automatic operation; 7) three times increased capacity; 8)



Cut-away diagram of pre-plasticizing section of Windsor's new injection machine shows components as follows: 1) nozzle, 2) heaters, 3) barrel, 4) screws, 5) barrel clamp, 6) water-cooled hopper throat, 7) hydraulic motor, 8) hopper, 9) worm, 10) ring gear and worm wheel, 11) needle rollers, 12) screw draw bar, 13) hydraulic injection ram, 14) hydraulic cylinder, 15) retraction cylinder, 16) slide bed, 17) thrust bearings, 18) lubricating pressure gage, 19) coupling, and 20) retraction cylinder piston rod

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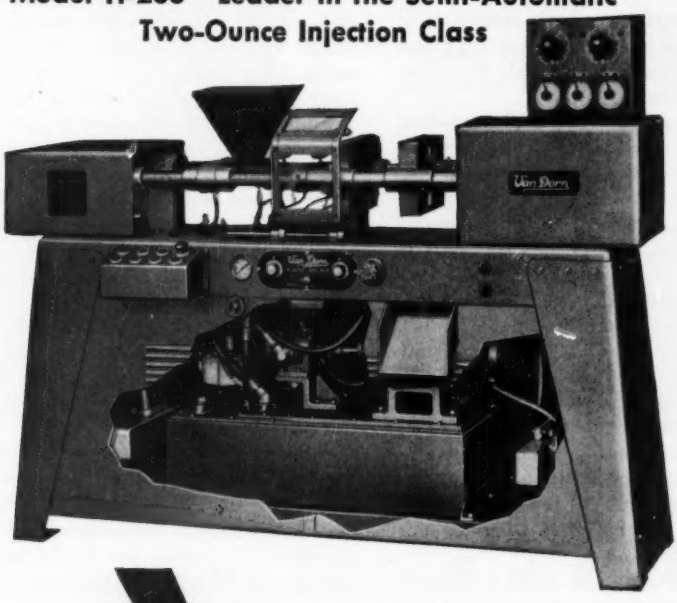
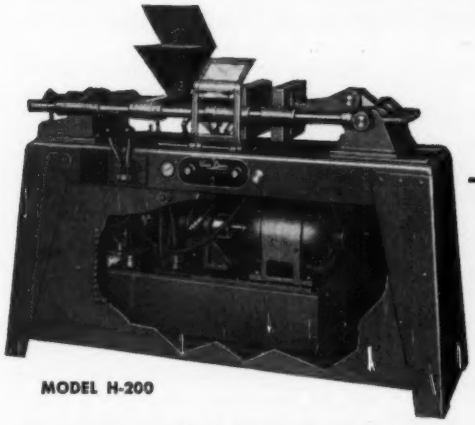
VAN DORN Equipment

Model H-200—Leader in the Semi-Automatic Two-Ounce Injection Class



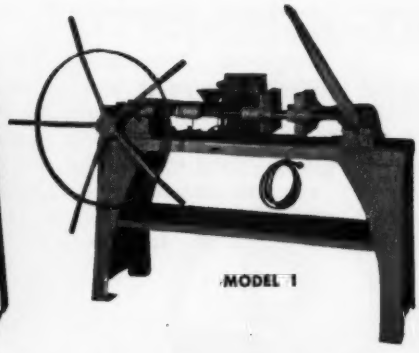
This ultra-modern press molds practically all thermoplastics including nylon. It completes up to 6 operating cycles per minute. Push button controls are safe, simple and convenient. Compact and rugged, the unit is quiet and economical in operation. Sliding gate with interlocking safety devices starts the cycle. Solenoid valves close the molds. Injection and dwell are controlled by first of three timers on the rear panel. Center timer regulates recharging of heater. The third timer controls the length of the mold close cycle; when time runs out, molds automatically open and parts are ejected. Operator opens safety gate, removes product and then closes gate to begin the next cycle . . . Variable voltage transformers in conjunction with thermostatic units control the temperatures on the two heating zones accurately.



MODEL H-200

Power Operated, Lever Controlled Presses

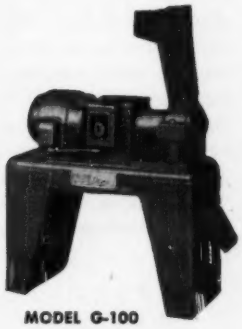
2-oz. or 1-oz. capacity. These low-cost units operate 8 hours for under a dollar and use inexpensive molds. Can easily be set up in twenty minutes by one man.



MODEL 1

Manually Operated Press

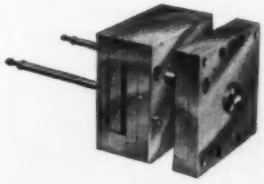
1-oz. capacity. This press is ideal for smaller jobs, experimental work and technical training.



MODEL G-100

Plastic Grinder

Grinds up rejects, waste, etc., for re-use. Ruggedly made, designed for easy cleaning.



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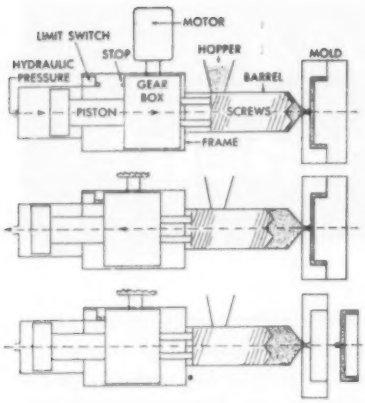


Diagrams illustrate 3-phase molding cycle of Windsor's 1044 Autoplas

low running cost; 9) fully plasticized homogenous material in the barrel; and 10) better quality moldings.

Specifications of the Autoplas machine are as follows:

Maximum capacity or swept volume is 44 cu. in. of fully homogenous material which is equal to: 32 oz. cellulose acetate, 26 oz. polystyrene, 32 oz. polyethylene, 30 oz. acrylic, 30 oz. cellulose acetate butyrate.

Plasticizing capacity rated in cellulose acetate at 120 to 140 lb. per hour.

Speed of injection stroke at maximum capacity is less than two seconds. This can be controlled to any speed below this figure for such materials as acrylic.

Complete cycle maximum capacity, for example, with polystyrene, less than one minute.

Maximum pressure on material is 10,000 p.s.i. Examples of actual test figures: polystyrene, 4000 p.s.i.; cellulose acetate, 4300 p.s.i.

Three-zone heat control with controlling pyrometer.

Size of mold plate ... 29½ by 25 in.
Tie bar centers ..... 18 by 18 in.
Mold opens ..... 12 in.
Max. mold thickness ..... 17 in.
Min. mold thickness ..... 8 in.
Mold locking force ..... 300 tons
Horsepower of motor 25
Approx. floor space 18 ft. by 4 ft. 6 in.

PAINTING MACHINES—For painting the inside surface of hollow parts, an automatic rotary-indexing machine has been developed by Conforming Matrix Corp., 364 Factories Bldg., Toledo 2, Ohio.

The machine consists of a rotating table having 24 work holders on which the parts to be painted are mounted, two movable spray nozzles, and accessory tubing and paint equipment. Painting is accomplished on the return stroke of the nozzle, with the work being revolved by a variable-speed air drive. The speed of the stroke during painting, and the speed of indexing can be dial-regulated, so that 400 to 1200 pieces can be painted per hour, two at a time. The machine operates in conjunction with a continuous circulating paint system and, if required, can be supplied with hot-spray equipment.

The unit can be built for 4-, 6-, 8-, 12-, or 24-station indexes, or for continuous movement.

THICKNESS MEASURING DEVICE—Weighing only 6 oz., and fitting easily into the palm of a hand, the Elcometer gage permits speedy measurement of the thickness of any non-magnetic material. The instrument, manufactured by East Lancashire Chemical Co., Ltd., Fairfield, Manchester, Eng., and distributed in the United States by Ferro Corp., 4150 E. 56th St., Cleveland 5, Ohio, operates on magnetic principles.

If the material to be measured is not a coating on a magnetic surface, it is placed on a ferrous base. A built-in permanent magnet in the gage creates a magnetic flux across an air gap in the instrument. Two contact spheres at the base of the instrument rest on the material being measured; the proximity of the ferrous surface to these two contact points varies the amount of flux across the air gap. Since the proximity of the ferrous surface is determined by the thickness of the material being measured, the degree of flux becomes a function of the material's thickness, and variations in flux can thus be shown as variations in thickness on a dial.

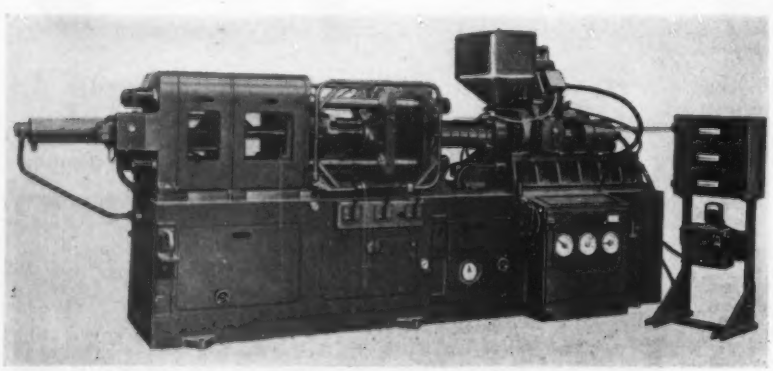
The instrument is available from stock with one standard scale. Seven special scales, calibrated in millimeters and thousandths of an inch, are available. Almost any range of scale is available on special order.

COMBINATION DIEMAKER—Steel rule bending, notching, cutting, and bent steel rule cutting are performed by the Cramaco steel rule diemaking machine introduced by Craftsmen Machinery Co., 575 Atlantic Ave., Boston 10, Mass.

Having an over-all size of 29 by 18 by 6 in. (including cutter table, side gages, and handle), the instrument is said to be capable of handling the hardest steel rule.

WINDING EQUIPMENT—An air-actuated brake for regulating tension of an unwinding web, split latch type sleeve bearings, and running adjustments for side lay and squaring are features of the Model UA single position unwind stand. The air brake can be regulated either by a manually operated pressure control, or by a pressure modulating device for automatic adjustment of braking as the web unwinds. The stand comes in various sizes for a variety of roll diameters, widths, and duties.

A continuous two-arm winder, Model 20, can be applied to winding rolls of web material on shafts, on expanding mandrels, or directly on cores. Flying core starts can be made at speeds up to 300 ft. per min., depending on the material. After the winding operation is started, its



Over-all view of Windsor's new injection machine with screw-type pre-plasticizer

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"UNDERWEAR"
for the
B-57 Night Intruder

Big, rangy B-57 Night Intruders are stretching out in space in insulating "underwear" tailored to order in Georgia. Here's the story:

We received a call at 4 o'clock on a Monday afternoon from one of our clients who wanted to bid on a contract involving a fiber glass cloth impregnated and coated on both sides with a vinyl material. He needed a compound that was *fireproof*, had low temperature *flexibility*, was *mildew, gasoline,* and *oil* resistant. The finished cloth had to be *non-porus* and *tack free* to prevent easy soiling. The production *price* had to be right, and he needed a sample to submit in 72 hours.

Flexible went to work.

Two days later, our customer had received a compound meeting all of the requirements. He got the contract.

If you have a problem that needs the kind of fast *flexible* service we offer . . . call or write us. Give us your specifications and we'll help you formulate the answer in record time.

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speed can be fully adjusted to suit the preceding operation. The distance between the rotating arms is fixed on the Model 20F, and standard fixed length shafts or fixed length cores (for shaftless operation) are required. The Model 20V, on the other hand, is adjustable to shafts or cores of different lengths, because it has movable rotating arms. Model 20 is available in six sizes, from 36 to 66 in. face (in 6-in. increments), and roll diameters up to 32 inches.

Both units are manufactured by Dilts Machine Works Div., The Black-Clawson Co., Fulton, N.Y.

HYDRAULIC POWER UNIT—Elimination of piping, screwed connections, and unnecessary valves, and ease of valve repair or replacement are claimed for Hydrau-Power-Pak, a high-power unit introduced by Clifton Hydraulic Press Co., 289 Allwood Rd., Clifton, N.J.

The equipment has a capacity range of 5 to 50 gal. per min. on the low pressure side and from ½ to 6 gal. per min. on the high pressure side; pressure extends to 10,000 p.s.i.

Relief valve, check valve, reservoir filter, air breather filter, and dial are standard equipment. Solenoid-controlled operating valve for automatic presses is optional.

PRESSES—A line of four-post hydraulic presses, designed for the small plastics molding shop, has been introduced by M & N Hydraulic Press Co., 870 Route 3, Allwood, Clifton, N.J.

These presses are available in 10-ton (6- by 6-in. platen), 20-ton (8- by 8-in. platen), and 30-ton (12- by 12-in. platen) pressure capacities. The platens are electrically heated and thermostatically controlled up to 450° F.

The presses are said to be adaptable for operation with a hand pump or may be powered by an existing central hydraulic system. Press cylinders are built for 3000-p.s.i. operation.

DRILL—Plastics materials can now be more efficiently worked with a new type of drill developed by Hayden Twist Drill Co., 8626 Lyndon Ave., Detroit 21, Mich.

The drill is carbide-tipped and of fluteless construction. It consists of a shank having a diameter between 50 and 60% of that of the carbide tip, the shank and tip being joined together by brazing. The manufacturer guarantees the drill against failure of the braze.

The abrasive chips formed in drilling plastics are rather difficult to handle in the conventional drill. By eliminating flutes entirely, the new drill is said to provide for faster penetration into plastics materials.

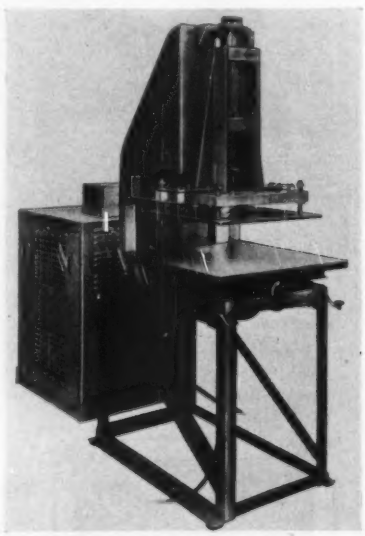
The drill can also be used on cast iron, but is not successful on steel.

SEALING UNIT—Suited to the sealing of large, bulky plastics products such as wading pools, life rafts, and oversize inflatable toys, a new dielectric heat sealing press, P-16, is available from Thermatron Div. of Radio Receptor Corp., 251 W. 19th St., New York 11, N.Y.

The press comes in bed sizes up to 25 by 60 in., and may be used with the company's high frequency generators from 6 to 20 kilowatts. It is accessible from three sides and may be operated with indexed turntables.

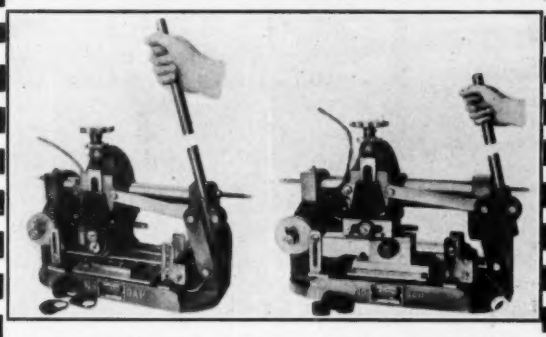
Air operated by foot or two-hand control valve, the press has speed controls which allow independent adjustment of the speed on down stroke and return. Both lateral and longitudinal bar sealing is possible, and sealing electrodes are interchangeable.

Power is turned on automatically when the electrode reaches sealing position and stays on for the duration of the sealing time.



Thermatron's model P-16 sealing press is accessible from three sides, has interchangeable sealing electrodes

No. 9AH HOT STAMPING MACHINES



These machines use a roll die to mark flat parts and flat dies to mark tubes and round parts. The motor driven models are the last word in high production plastic parts marking.

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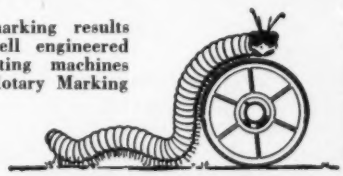

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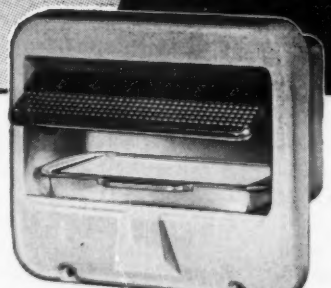

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BOOKS AND BOOKLETS

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Techniques of Plant Maintenance and Engineering"

Proceedings of the Technical Sessions (sponsored by the American Society of Mechanical Engineers and the Society for the Advancement of Management) held concurrently with the Fourth Plant Maintenance Show, Cleveland, 1953. Published in 1953 by Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y. 288 pages. Price $6.00.

Covering general management problems, such as area versus centralized maintenance, labor relations, incentive and work measurement, etc., as well as particular problems related to specific industries such as automotive, chemical, rubber goods, and the like, this volume focuses on the day-by-day problems confronting the plant maintenance engineer. The stenographic transcript of the various papers read at the Fourth Plant Maintenance show and panel discussions held there are presented.

"Textbook of the Materials of Engineering," by Robert F. Moore and Mark B. Moore.

Published in 1953 by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N.Y. 372 pages. Price $6.00.

The purpose of this eighth edition, like that of the first, is to furnish a concise presentation of the physical properties of the common materials used in structures and machines, together with brief descriptions of their manufacture and fabrication. Emphasis is on those properties which affect the strength, stiffness, ductility, and resistance to wear of such engineering materials. This latest edition of the text provides a fairly extended treatment of numerous plastics as applicable to structural engineering.

"Plastics for the Home Craftsman," by Rodney Hooper.

Published in 1953 by J. B. Lippincott Co., E. Washington Sq., Philadelphia, Pa. Made and printed in Great Britain. 166 pages. Price $3.00.

Hobbyists who wish to try their skill on plastics will find many valuable suggestions in this volume. Though written in England and thus having many references to British trade names when discussing plastics materials, the book nevertheless provides a good basis from which the beginner in plastics craftsmanship can proceed. The outstanding aspect of this particular contribution to the field of plastics hobbies is the fact that it goes beyond the simple tasks of gluing, bending, and carving, which is what many other volumes concentrate on, and introduces the reader to such processes as laminating, blow-molding, bag-press laminating, and the like, indicating in each instance how home made equipment can be constructed for these operations. Naturally, only thermoplastic compounds are covered.

"The Furans," by A. P. Dunlop and F. N. Peters.

Published in 1953 by Reinhold Publishing Corp., Book Div., 330 W. 42nd St., New York 36, N.Y. 876 pages Price $18.00.

In this volume, No. 119 in the American Chemical Society Monograph Series, the authors offer the first comprehensive treatment ever published on the subject of furan chemistry and its industrial applications. The work is divided into two parts. In Part I an attempt is made to draw some more or less general conclusions with reference to the chemical behavior of furan compounds and to present a review of published literature in the field. Part II deals in a general way with the applications of furfural and its derivatives as a chemical intermediate, as a solvent, and as a resin-forming compound. The work will find particular interest with industrial research personnel, especially in the fields of petroleum, vegetable oils resins, and organic chemicals.

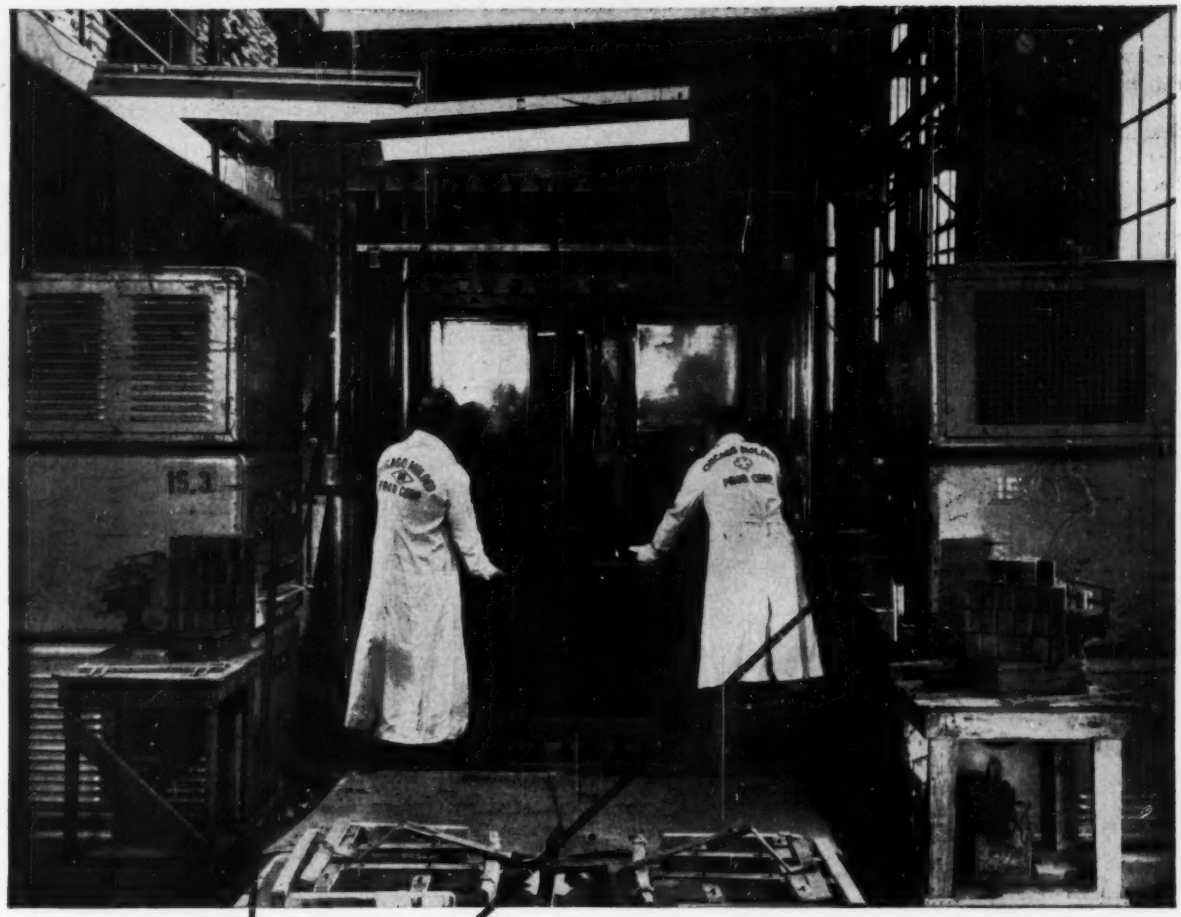
Extrusion—Applications of extruded thermoplastic components to consumer products and industrial products and processes are illustrated in this 12-page booklet entitled "Extruded Plastics," which also describes the company's custom extrusion operation. Special sections deal with the general size and range of extrusions, and the company's facilities to fabricate them for consumer and industrial end use. Also included is a summary of the properties of various plastics materials used in extrusion. *Anchor Plastics Co., Inc., 36-36 36th St., Long Island City 6, N. Y.*

Furan — Production and availability, shipping and handling information, data on physical and chemical properties, and uses of furfuryl alcohol are contained in 28-page Bulletin 205. A bibliography rounds out the bulletin. *Chemicals Dept., The Quaker Oats Co., Merchandise Mart, Chicago 54, Ill.*

Bleed test — Two-page report describes equipment and procedures used in testing the compatibility of materials in a polyvinyl chloride compound by means of ultra-violet radiation. According to the company, this test—which has been used in their laboratories for about seven years—has shown a very high correlation with results found in actual production operations. The test does not indicate effect of aging on color or physical property. *Deecy Products Co., 120 Potter St., Cambridge 42, Mass.*

Modified polystyrene — Four high-elongation, high-impact, and three medium-elongation medium-impact modified polystyrenes are described in Technical Bulletin C-3-161. Information on parts manufacture, injection and compression molding, mold design extrusion, and finishing is given. *Koppers Co., Inc., Chemical Div., Koppers Bldg., Pittsburgh 19, Pa.*

Resorcinol — Applications for this intermediate chemical are enumerated in Booklet C-3-175. These include its use in the formation of adhesives, based on the reaction between resorcinol and formaldehyde in the formation of thermosetting resins; its partial replacement of phenol in phenol-formaldehyde plastics for speedier cure at lower temperatures; its function—in ester form—as a light stabilizer for cellulosics, vinyls, and polystyrenes; and others. The booklet also presents a page of technical data covering spe-



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cification data of the compound. *Koppers Co., Inc., Chemical Div., Pittsburgh 19, Pa.*

Stabilizer—Physical properties of stabilizer C-77—a complex cadmium heat and light stabilizer which does not contain fatty acids—are described in Technical Data Sheet 4053. Suggested applications and formulations are also included. *Advance Solvents & Chemical Corp., 245 Fifth Ave., New York 16, N. Y.*

Abrasive-belt grinding—Booklet contains 46 case studies on abrasive-belt grinding methods which effected savings on machining operations in various industries. *Porter-Cable Machine Co., 23 Exchange St., Syracuse, N. Y.*

Wet tumbling—Used for deburring, cutting down, smoothing, and burnishing forged, stamped or cast parts by tumbling them in water with abrasive material, Type XL wet-process tumbling barrels are described in bulletin XL-52. The bulletin deals with drive mechanism, electric controls, and details of barrel construction. Specifications on six standard units are given. *Tumb-L-Matic, Inc., 4510 Bullard Ave., New York 70, N. Y.*

Chemical catalog—This 1953 catalog lists over 150 chemicals including carbon blacks, rubber chemicals, stearates, driers, plasticizers, vinyl stabilizers, fungicides, gelling agents, stearites, etc., and describes each one as to type, form, properties, application, and packing. *Witco Chemical Co., 260 Madison Ave., New York 16, N. Y.*

Coatings and adhesives—Epoxide coating material Hysol 6111 is described in Technical Bulletin 6111. It will cure at room temperatures, has good chemical resistance, and covers 820 sq. ft. per gal. at 1-mil thickness. Applications for this material are in the coating of large objects (tanks, trucks, railroad cars, etc.) without need of baking. Technical Bulletin 2000 describes the Hysol 2000 series of cold- and heat-setting adhesives. The former are pressure sensitive, will cure at room temperatures, and are intended for bonding glass, metal, ceramics, hard rubber, and plastics. Putties, gap filling compounds, and sealants can be made by adding wood flour, cork, aluminum flake, talc, and similar fillers. The heat-set adhesives are cured at temperatures from 70 to 180° C. They are intended for use with metals, ceramics, glass, and combinations thereof. Both bulletins contain application notes and results of tests. *Houghton Labs., Inc., Olean, N. Y.*

Isotope catalog—Descriptive material and prices for over 100 radioactive and 175 stable isotopes, produced by Oak Ridge National Laboratory for use in medicine, agriculture, industry, and general science, are listed in this catalog. Price: $1.00 per copy. *Carbide & Carbon Chemicals Co., Oak Ridge National Lab., Radioisotope Sales Dept., P. O. Box P., Oak Ridge, Tenn.*

Resin plant—Design factors to be considered in the establishment of a resin plant—construction materials, instrumentation, and methods of agitation, heating, and cooling—are discussed in Bulletin 2141. Pilot plants as well as full production units are covered. *Blaw-Knox Co., Process Equipment Dept., Farmers Bank Bldg., Pittsburgh 22, Pa.*

Tar bases—Uses, properties, typical reactions, hazards, methods of handling, and test methods are described in the book "Barrett Tar Bases." The 100-page publication provides specification data for a selected group of the firm's tar bases, describes actual uses to which they have been put in industrial fields, and contains a host of technical data. *Barrett Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.*

Wire thread inserts—Bulletin 652 introduces new specifications for the company's wire thread inserts for average mass production requirements, high-quality mass production needs, and high-precision interchangeable manufacture. An introductory section outlines the features and possibilities of this aid to assembly, maintenance, and salvage operations. *Heli-Coil Corp., 1360 Shelter Rock Lane, Danbury, Conn.*

Engineering monthly—A monthly engineering bulletin, called Tech-Key, and intended for key technical personnel in the processing and allied fields, will consist of the mathematical treatments of important practical problems within the fields of mechanical and chemical engineering. One new process engineering and one mechanical engineering topic will be discussed each month. At the same time, applications to specific equipment or techniques, based on these mathematical analyses, will be outlined. *Techniflex Corp., Port Jervis, N. Y.*

Plastics reels—Problems of timing, warpage, winding, threading, and tape spillage from magnetic recording reels and their solution through improved design of a plastic reel are discussed in technical bulletin No. 23. *Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul 6, Minn.*

Tension brakes—Useful for yarn and wire winding applications or for similar loading devices requiring constant torque, two new magnetic tension brakes of the hysteresis type are described in Bulletin GEA-5867. The units provide braking action by magnetic field, have no rubbing parts to wear, and furnish constant torque almost indefinitely. Torque ranges for the two brakes are 0.4 to 4.0 and 2.0 to 14.0 oz./in., respectively. *General Electric Co., Schenectady 5, N. Y.*

Epoxy resin—Pigmented and filled modifications of Hysol 6020, a liquid epoxy resin which cures at room temperature, are described in technical bulletins 603 and 6020. Addition of fillers to the resin results in better heat conductivity, lower shrinkage, and reduced thermal expansion. Addition of inorganic pigmentation does not materially change the properties of the compound. The resin was developed primarily for electronics applications. *Houghton Laboratories, Inc., Olean, N. Y.*

Hydraulic cylinders—Bulletin 52-55 lists all hydraulic (oil) cylinder models available from the company. The bulletin illustrates representative types of mountings for single- or double-end piston rod cylinders, standard or heavy-duty piston rods, and cushioning arrangements for either one or both ends of cylinders. Complete specifications for each model are given and installation information is included. A 6-page section of engineering data offers charts and tables to determine working

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pressure for pipe and tubing, internal diameters and areas for pipe and tubing, flow capacity of pipes at recommended flow velocities, piston areas, fluid displacements, and output forces for cylinders with standard and heavy duty rods, and theoretical maximum stroke length for full compression loading of piston rods. Flow control and metering circuits are also discussed. *Vickers Inc., Div. of The Sperry Corp., 1400 Oakman Blvd., Detroit 32, Mich.*

Sterilization—Sterilization procedures and equipment are listed in catalog C-131. Of particular interest to the plastics industry are those units which have been designed to sterilize heat sensitive materials. For such materials the company offers cold-process sterilizers utilizing Carboxide gas. The catalog includes diagrams, cross section views, and engineering data. *American Sterilizer Co., Erie, Pa.*

Industrial chemistry—An overall survey of the chemical industry in the United States is presented in "The Chemical Industry Facts Book." Its more than 100 pages give a historical summary of the industry's growth, an outline of the mode of operation peculiar to the chemical industry, and a picture of the impact it has had on the American standard of living. Single copy price $1.00. Quantity prices on request to *Manufacturing Chemists' Association, Inc., 350 Fifth Ave., New York 1, N. Y.*

Fibrous glass laminates—The nature and possible future uses of polyester fibrous glass laminates are described to the technically untrained manufacturer in "A Sketchbook of Profitable Products." Design, molding, and fabricating problems are discussed and numerous applications are suggested. Profusely illustrated. *Monsanto Chemical Co., Texas Div., Texas City, Texas.*

Development service—Facilities for the development of ideas in plastics are described in "Idea to Product." The booklet also includes a description of properties and applications of Plastrong reinforced plastics products, and a section on forming thermoplastic sheeting as done by the company. The firm claims know-how and equipment for every phase of plastics processing except injection molding. *Basson Industries Corp., 1432 W. Farms Rd., New York 60, N. Y.*

Polyvinyl chloride—Mechanical, electrical, thermal, and other properties, as well as chemical resistance of Boltatron 6200, a non-plasticized polyvinyl chloride designed primarily for industrial use where corrosion problems are important, are outlined in this folder. Application notes are included. *H. N. Hartwell & Son, Inc., Park Sq. Bldg., Boston, Mass.*

X-ray analysis—Differences in X-ray powder camera, spectrometer, and spectrograph equipment and techniques are discussed in "Twenty Questions and Answers on X-ray Analysis." The booklet also explains specimen preparation and describes application fields for each of the three X-ray diffraction methods. This booklet is free. Also available from the company at a cost of $1.00 is an X-ray calculator to be used with X-ray spectrograph instruments for the speedy identification of elements and wavelengths (in Angstroms) from angular readings in

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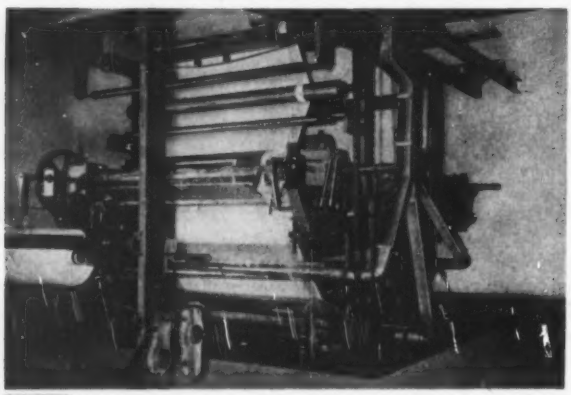

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degrees. *Research and Control Instruments Div., North American Philips Co., Inc., 750 South Fulton Ave., Mt. Vernon, N. Y.*

Plastics pipe—Results of a survey of the uses and performance of Tenite II rigid and polyethylene flexible pipe are contained in a booklet entitled "Facts You Should Know about Plastic Pipe." The booklet points out the advantages of these plastics pipes over those made of other materials. *Waljohn Plastics, Inc., Industrial Div., 435 88 St., Brooklyn 9, N. Y.*

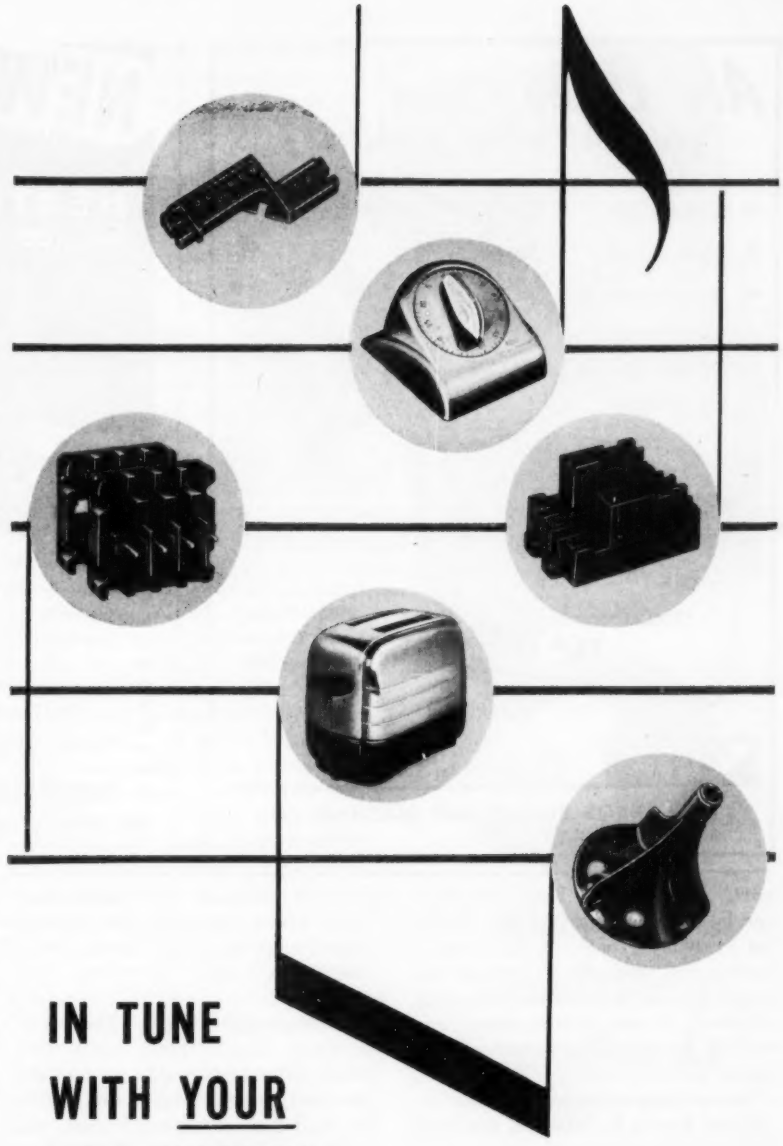
Instrumentation—Technical case histories and general information articles from the company's quarterly publication "Instrumentation" are listed in an alphabetical index. Instrumentation and automatic control applications in the steel, chemical, textile, plastics, packaging, rubber, and other industries are covered. *Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 44, Pa.*

Job incentives—Methods used by major companies in getting their employees to do better work are compiled in the booklet "The Incentive Story." *Cappell, MacDonald & Co., Dayton 1, Ohio.*

Monomeric plasticizer—Technical bulletin 47 gives specifications, typical characteristics, and performance data for Plastolein 9075 DIOZ (di-iso-octyl-azelate). The compound is a primary monomeric plasticizer for all types of vinyls, cellulosics, and synthetic rubbers. *Emery Industries, Inc., Carew Tower, Cincinnati 2, Ohio.*

Metal hose—Helically-wound flexible metal hose and helically corrugated flexible metal hose are illustrated and described in catalog No. 200. Included is an engineering data section showing frictional losses versus flow rate for various sizes of metal hose and conduit and giving installation and maintenance information. *Titeflex Inc., 500 Frelinghuysen Ave., Newark 5, N. J.*

Heat for vinyl—High speed fusing, embossing, and laminating of vinyl materials by means of infra-red electric heat are the subject of the 10-page folder called "The Vinyl Re-



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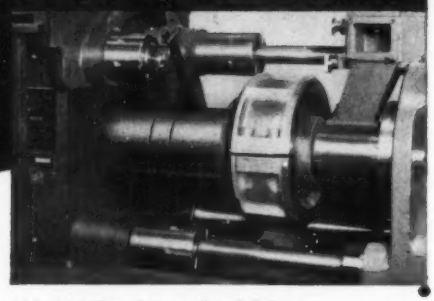
REPLACEMENT
HEATING CYLINDER
for 10D-8 oz. Injection Machines



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- Ceramic heating elements included
- Quick field installation
- No new mounting equipment needed

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More plasticizing...faster cycles...higher quality parts

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port." It points out how cast vinyl can be fused in 10 sec. at belt speeds up to 100 yd. per minute. Correct speeds and temperature settings are suggested for plastisol and organisol materials, in cast or calendered form, with supported or unsupported film. Technical data and specifications on a line of radiant heaters are also included. *Edwin L. Wiegand Co., 7500 Blvd., Pittsburgh 8, Pa.*

Vinyl film—Typical applications for Koroseal supported and unsupported sheet are described and illustrated in this 12-page booklet. Results of abrasion, color-fastness, aging, tear, and flexing tests are given. *Koroseal Sales Promotion Dept., B. F. Goodrich Co., 500 S. Main St., Akron, Ohio.*

Corrosion resistance—Plastics materials for construction are discussed in this 35-page booklet prepared specifically for corrosion engineers. *The Atlas Mineral Products Co., Mertztown, Pa.*

Structural plastic—General description, properties, and typical applications of Conolon, a fibrous glass reinforced phenolic used extensively in the aircraft industry, are listed in this 8-page bulletin. *Narmco, Inc., San Diego, Calif.*

Thermoplastic resin—Properties, available forms (lump, pulverized, flake, 40%-solids emulsion, and dry powder), solubility and compatibility, and uses of Vinsol, a dark-colored, low-cost thermoplastic resin are described in a 16-page booklet called "Vinsol." The compound finds application in adhesives, asphalt emulsions, hydraulic cement, electrical insulation, inks, floor coverings, plastics, protective coatings, and shoes. *Hercules Powder Co., Wilmington 99, Del.*

Trifluorochloroethylene — Physical, electrical, chemical, and mechanical properties of Kel-F are discussed in technical bulletin 1-3-53. The bulletin points up such properties as chemical resistance, compressive strength, temperature utility, insulating resistance, zero moisture absorption, optical characteristics, and low vapor-moisture transmission. Notes on molding, machining, and fabricating methods are given, as well as a summary of applications. *The M. W. Kellogg Co., Chemical Manufacturing Div., P. O. Box 469, Jersey City 3, N. J.*

Foil and leaf—A line of materials for use in hot die stamping is listed in this 16-page booklet. Included are color foils, bronze roll leaf, aluminum foil, metallic colors, and genuine gold. A line of presses for all hot die stamping applications is also shown. *M. Swift & Sons, Inc., 1 Love Lane, Hartford, Conn.*

Testing device—Standard and deluxe models of Super "L" testing machines are described in Bulletin 47. The bulletin also outlines the principle of operation of the firm's electronic indicating system, which provides a 50 to 1 spread of testing ranges and permits changing of ranges during test by simple switching. *Tinius Olsen Testing Machine Co., 1068 Easton Road, Willow Grove, Pa.*

Extrusion—The company's facilities for extruding all type of thermoplastics to customers' specifications are outlined in this 4-page folder. Also

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Thickness: .005" to .035"
Dimensions: any length; all widths to 54"
Colors: clear; translucent or opaque, white and other shades

Vacuum forms readily
Laminates well
Good dimensional stability
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Applications: displays, doll faces, calendar cards, templates, signs. Technical assistance available from men who "know how."

Planished sheets are also available from .0075" to .250" thick, in various widths.

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included is a listing of the company's line of pipe, fittings, and tubing. *Pyramid Plastics, Inc., 554 W. Polk St., Chicago 7, Ill.*

Vocational program—The Committee on Plastics Education of the S.P.I. has prepared a booklet—available to all technical, vocational, and high school educators—outlining a program of plastics education at these levels. In addition to presenting a suggested curriculum of courses, the booklet also furnishes basic statistical information on the plastics industry, its subdivisions, its geographical distribution, and the employment opportunities it offers. *The Society of the Plastics Industry, Inc., 67 W. 44 St., New York 36, N. Y.*

Plasticizer—Sancticizer 160, a butyl benzyl phthalate characterized by low volatility at calendering and extruding temperatures, good oil extraction, and heat and light stability, is described in Technical Bulletin No. 0-92. The compound is particularly recommended as a primary plasticizer for polyvinyl chloride resins. In addition to giving the physical and chemical properties of the product, the bulletin contains data on its compatibility with various resins, its stability, solvent action, and its effect on vinyl film as compared with other commonly used plasticizers. *Monsanto Chemical Co., Organic Chemicals Div., St. Louis 1, Mo.*

Chlorinated naphthalene—Characteristics of a representative group of Halowax refined, fractionated, and crude chlorinated naphthalene products are described in "Halowax Chloronaphthalene Oils and Wax-like Solids." Tables of compatibility and solubility as well as individual descriptions of eight representative chloronaphthalenes are included. The compound has high chemical stability, is a good dielectric, and has flame and fungus growth resistance. *Bakelite Co., A Div. of Union Carbide and Carbon Corp., 260 Madison Ave., New York 16, N. Y.*

Acrylic letters—Bulletin 138 lists over 30 concerns who manufacture three-dimensional Plexiglas letters and offer them for sale in the northeastern states. Letter styles and available sizes are given. *Plastics Dept., Rohm & Haas Co., Washington Sq., Philadelphia 5, Pa.*

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Production of

FOR the purpose of this report, production is the sum of the quantities of materials produced for consumption in the producing plant for transfer to other plants

PLASTICS AND SYNTHETIC RESIN PRODUCTION
From Statistics Compiled

Materials	*Total p'd'n. first 4 mos. 1953*	*Total sales first 4 mos. 1953*
CELLULOSE PLASTICS:[a]		
Cellulose acetate and mixed ester plastics:		
Sheets, under 0.003 gage	5,260,376	5,265,761
0.003 gage and over	4,306,817	4,084,802
All other sheets, rods and tubes	1,899,474	1,718,695
Molding, extrusion materials	26,344,326	25,993,913
Nitrocellulose:		
Sheets	2,389,960	2,067,632
Rods and tubes	177,426	263,176
Other cellulose plastics[b]	2,378,177	2,338,448
PHENOLIC AND OTHER TAR ACID RESINS:		
Laminating	27,429,782	18,886,854
Adhesive	17,026,691	15,698,507
Molding and casting materials[a]	77,601,486	78,145,408
Protective coatings (modified and unmodified except by rosin)	10,772,809	9,750,317
Miscellaneous uses	28,616,575	25,247,684
UREA AND MELAMINE RESINS:		
Adhesives	26,993,318	26,603,756
Textile-treating resins	11,620,935	11,765,969
Paper-treating resins	7,273,049	7,697,482
Protective coatings, modified and unmodified	10,306,474	7,689,400
Miscellaneous uses, including laminating and molding[c]	24,587,548	27,654,017
STYRENE RESINS:		
Molding materials[a]	112,927,627	108,762,418
Protective coatings, modified and unmodified	23,768,430	29,824,803
Miscellaneous uses	30,380,144	26,924,562
VINYL RESINS:[d] Total	178,550,494	173,287,312
Sheeting and film (resin content)[e]		51,546,479
Adhesives (resin content)		7,786,400
Textile and paper-treating resins (resin content)[f]		18,313,638
Molding and extrusion materials (resin content)		59,571,718
Protective coatings (resin content)		9,818,678
Miscellaneous uses (resin content)		12,478,883
COUMARONE-INDENE AND PETROLEUM POLYMER RESINS:	60,903,337	58,490,427
MISCELLANEOUS SYNTHETIC PLASTICS AND RESIN MATERIALS:		
Molding materials[a,g]	45,218,981	42,410,877
Protective coatings[h]	2,716,620	1,733,919
All other uses[i]	43,276,071	43,563,455

* Dry basis is designated unless otherwise specified. [a] Includes fillers, plasticizers, and extenders. [b] Includes sheets, rods, and tubes, and molding and extrusion materials. [c] Data on resins for laminating and miscellaneous uses are on a dry basis; data on molding materials are on the basis of total weight. [d] Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total produc-

Plastics Materials

of the same company, and for sale. Sales include only the quantities involved in bona fide sales in which title passes to the purchaser.

IN POUNDS* FOR MARCH AND APRIL 1953
by U. S. Tariff Commission

March 1953		*April 1953*	
Production	*Sales*	*Production*	*Sales*
1,556,112	1,500,992	1,415,317	1,355,596
1,244,241	1,246,703	1,296,867	1,101,077
547,422	528,999	472,068	426,438
7,101,619	6,976,129	7,043,714	6,884,477
674,383	573,490	615,150	518,373
31,584	68,570	43,467	63,172
712,983	586,213	602,072	596,206
7,040,352	4,785,494	7,064,686	5,092,824
4,947,345	4,479,856	3,867,577	3,533,914
21,169,632	21,033,348	23,286,772	20,906,332
3,072,617	2,634,127	2,673,588	2,537,084
7,686,148	6,489,858	7,332,148	6,096,706
8,014,284	7,604,466	7,782,399	8,151,167
2,739,809	2,795,891	2,747,592	2,517,303
1,955,369	1,628,319	1,169,597	2,136,967
2,094,052	1,384,819	2,956,491	2,357,734
7,401,131	7,426,548	6,798,129	7,337,572
32,021,809	28,222,106	27,793,849	29,572,839
7,480,985	7,821,658	8,020,514	8,408,836
8,211,036	7,234,217	7,969,756	7,271,108
46,721,431	45,511,946	46,295,482	43,976,240
	17,574,822		16,574,133
	1,918,053		1,990,838
	4,950,341		4,934,015
	14,906,442		15,331,652
	2,479,647		2,344,895
	3,682,641		2,800,707
16,356,035	15,872,094	15,244,141	13,628,734
12,035,602	12,406,160	11,672,758	10,691,203
690,127	425,853	726,092	451,784
10,910,579	11,149,363	10,784,865	10,622,166

tion are given. * Prior to January 1951, statistics were given on the basis of total weight. [f] Includes data for spreader and calendering-type resins. [g] Includes data for acrylic, polyethylene, nylon, and others. [h] Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective coating resins. [i] Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.

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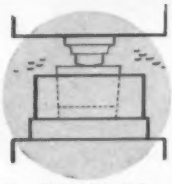
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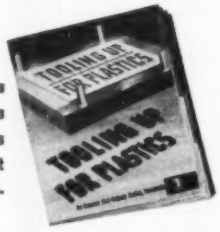

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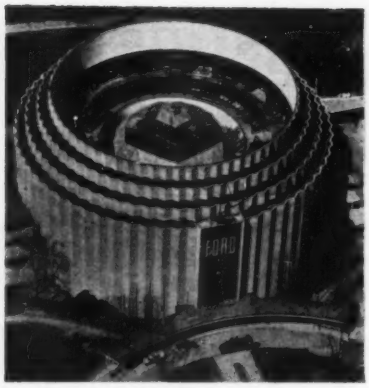

Reinforced plastics make possible construction of a lightweight, strong dome

Geodesic Dome

BY APPLYING techniques learned in strengthening wings and fuselages of large planes, a revolutionary lightweight geodesic has been built of reinforced plastics. The dome, which stands 46 ft. high and has a base diameter of 93 ft., covers the inner court of the Ford Rotunda, a circular structure conceived by W. B. Ford Design Corp. as an exhibition hall in Dearborn, Mich.

The dome, designed by R. Buckminister Fuller, consists of an aluminum framework covered with a shell of reinforced plastic panels. Base of the dome is 60 ft. above the ground, at which level construction was started on a platform surrounding a central steel mast. As the framework was built downward and outward from the top of the mast to the level of the platform, the mast was jacked higher and the operations repeated until the supporting structure for the dome was complete.

The mast was then removed and 1/25 in. thick, triangular sheets of fibrous glass bonded with Bakelite polyester resins were riveted to the outside of the triangular frame. The attractive, translucent sheets were formed by joining together smaller diamond-shaped panels, molded by Molded Fiberglass Sheet Co., Ashtabula, Ohio.

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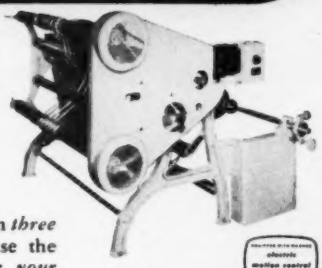

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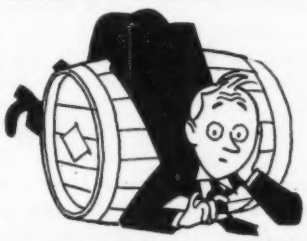

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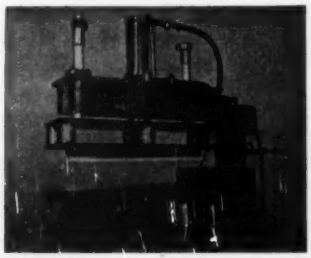

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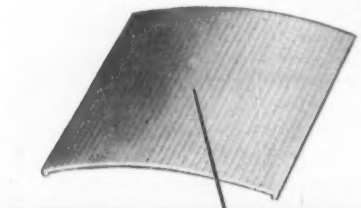

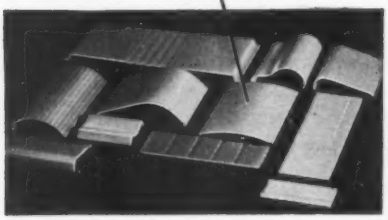

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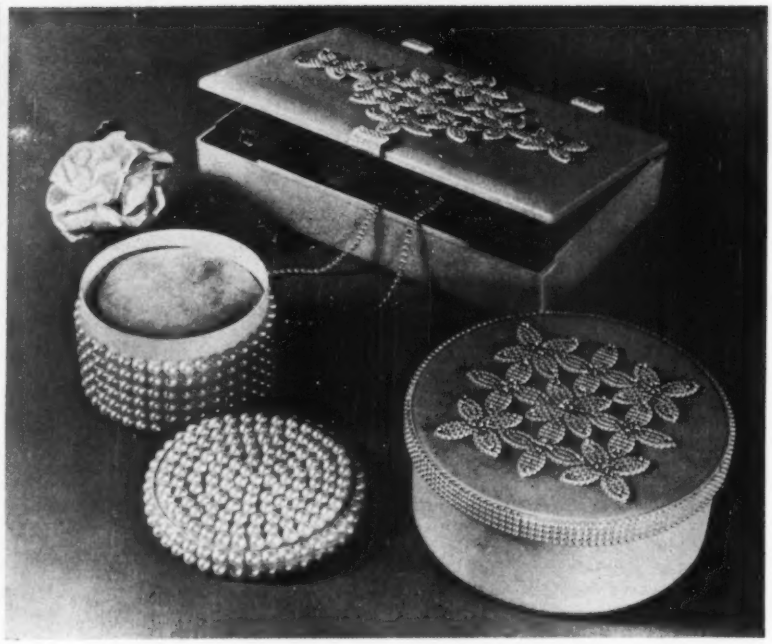


Customized luxury novelties—for use as boudoir accessories—are created by spraying molded styrene boxes with paint and then encrusting them with pearls or rhinestones

Luxury Novelties from Stock Boxes

BY ENCRUSTING molded styrene boxes with pearls and rhinestones, plain stock plastic containers are transformed into customized boudoir accessories.

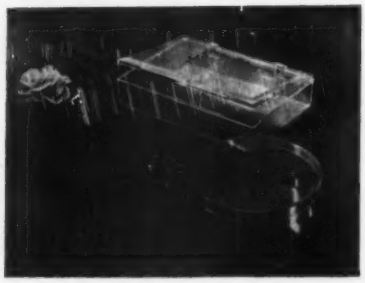
Originally a private hobby of Mark and Helen Plant, two former show people, the manufacture of these novelties has now grown into a successful business catering to luxury shops and retail outlets all over the country. Today, the Plants' shop, located in New York, N. Y., is providing a growing new market for ordinary styrene boxes manufactured to regular stock sizes and shapes.

Each of the transparent boxes, which are supplied by Tri-State Plastic Molding Co., Inc., Henderson, Ky., is prepared individually. A paint is first sprayed on the boxes and pearls and rhinestones are then applied over the paint without benefit of patterns.

Each of the decorative pearls and stones is dipped into glue by skilled workmen and laid on the top, sides, or bottom of the boxes as the imagination of the workmen dictates. As a result, the finished boxes are completely individualistic—no two are alike—and often have unusual and intriguing designs.

Among the luxury customized accessories which have been created by the enterprising Plants is a round boudoir box completely covered with pearls. This unit is produced in two sizes—a large one sells for $20 and a smaller version for $10. A similarly shaped box with a pearl trim and a center design of inset rhinestones is sold at luxury shops for $10. Another popular accessory is a large square jewel case, which is also decorated with pearls and rhinestones in a pleasing cover arrangement.

Ordinary styrene boxes—in round and square shapes—before their transition



Staked Your Claim in the New Flexible Market?

You Can Get Your Share without added Investment

YOU CAN STRIKE it rich in the flexible products market! It's new, big... *growing bigger!* And best of all, your present equipment can do the job. You don't spend a dollar extra on machinery! All you need is a change to VINYLITE Brand Plastic flexible molding compounds. These materials can be fabricated easily on standard molding machines.

Just look at these properties! They represent virtually unlimited product range ... great sales and profit potentials!

FLEXIBILITY...
to almost any degree, from soft and rubbery to semi-rigid... withstand long flexing without cracking.

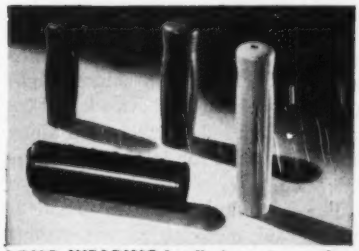
COLOR...
in practically every shade... in transparent, opaque or translucent form with lustrous finish.

DURABILITY...
non-fading, abrasion-resistant... deliver extra-long service.

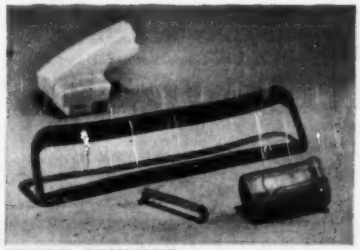
RESISTANCE...
to oils, most chemicals, corrosive atmospheres, greases, water, alkalies.

ADAPTABILITY...
to high speed injection molding or extrusion. The temperature range for successful molding is highly flexible.

This brief summary of properties can only hint at what you could develop for *your* business through *flexible* production with VINYLITE Plastic flexible molding compounds. Get the full picture... complete technical information, present applications... by writing for the illustrated booklet, "VINYLITE Extrusion and Molding Resins and Plastics." Address Dept. RT-13.



LONG-WEARING handle bar grips emphasize the many outstanding features of VINYLITE Plastic flexible compounds — lasting flexibility, wide color range, resistance to perspiration. By Hungerford Plastics Corp., Rockaway, N. J.



TOUGH, RESILIENT vacuum cleaner parts, molded of VINYLITE Plastic flexible compounds, can take long, hard usage. Production is quick, economical; any color can be specified. By Hungerford Plastics Corp., Rockaway, N. J.

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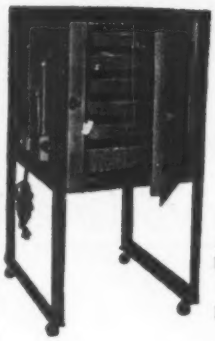
BROSITES OVENS and DRYERS

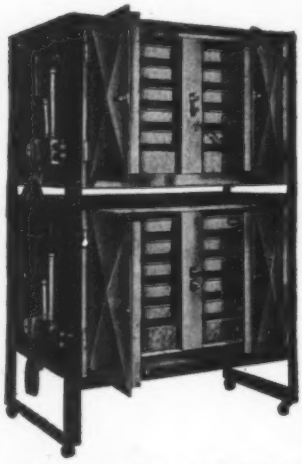
• SIMPLE AND FAST TO OPERATE



MODEL NO. 1
Single Door: Width 24½"
Five trays 15" x 22" x 2½"
Height 50"—Depth 28½"
Heating Element 1800 watts.
Thermostatic Control 100° to 300° F.

MODEL NO. 2
Double Door: Width 48"
Height 50"—Depth 28½"
Ten trays 15" x 22" x 2½"
Heating Element 3600 watts.
Thermostatic Control 100° to 300° F.

MODEL NO. 3
Double Decker:
Width 48"
Height 68½"—Depth 28½"
Twenty Trays 15" x 22" x 2½"

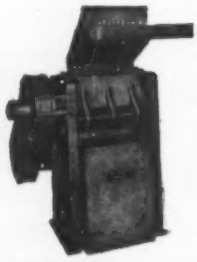


Model No. 3 is two Model 2 units placed one above the other. They can be operated independently of each other and the top unit can be used in reverse position whenever desired.

RUGGED, made to last . . . EFFICIENT, economical to use

The trays are of such size and design to hold approximately 10 pounds of the average material when placed to a depth of about one inch. Special trays of expanded metal allowing greater circulation of heat can be supplied and are recommended for the pre-heating of pellets and other solid objects. For special uses the trays, or the entire unit if required, can be made of stainless steel, monel metal or nickel. Sturdy in construction, built of steel sheeting, carefully and thoroughly insulated with rock-wool insulation placed between the inside and outside shells of the dryer. Mounted on casters for easy movement from on location to another in the plant. Each unit is equipped with thermostat to automatically control temperature of the oven. A light indicates when unit is in operation.

• JUST PLUG IN AND TURN THE SWITCH



DE MATTIA GRANULATOR
For the uniform grinding of Vinylite, Geon and all hard thermoplastics. Capacity: 200 lbs. per hr. 3 H.P. motor with double V belt drive. Four Steel Chopper Blades. Roller Bearings with Positive Seals. Screen with ¼" openings.

DE MATTIA *Bench Model* GRANULATOR
For *at-the-machine operation* (Can also be supplied with base for floor mounting). Capacity: 75 lbs. per hr. 2 H.P. direct connected motor. Roller Bearings with Positive Seals. Screen with 11/32" opening.

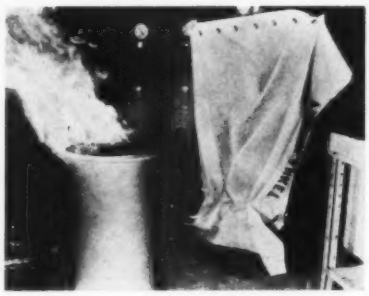
DE MATTIA CHUNK CUTTER
For low-cost salvage of larger slugs and chunks and molded pieces too tough for the average sprue and scrap grinder. Capacity: over 150 lbs. per hr. 3 H.P. motor in base. Double V belt drive. Roller Bearings with Positive Seals.

BROSITES MACHINE COMPANY INC.
50 CHURCH STREET (Cable Address—BROMACH) NEW YORK 7, N. Y.

Fire Blanket

VINYL-coated glass cloth fire blankets serve as protection for both human life and small industrial equipment during a fire. When thrown over the person or machine enveloped in flames, the rugged blanket quickly smothers the fire by cutting off the supply of oxygen.

By coating the blanket with a compound made from Geon vinyl resins, Standard Safety Equipment Co., Chicago, Ill., manufacturer of the blanket, has added extra strength and durability to the normally strong glass cloth. The vinyl coating resists acids, alkalies, and most solvents and chemicals. It will stay flexible at temperatures below 0° F. and will not support combustion. To clean this vinyl surface, flushing the entire unit with water or wiping it with a damp cloth is all that is necessary.



Vinyl-coated glass cloth blanket quickly smothers industrial and other fires

Because of the coating's resistance to sun, wind, or rain, the blanket can be safely hung outdoors as well as indoors. The coated blanket will withstand years of exposure without danger of any fire retardant washing out.

The blanket, which is approximately 30% less expensive than the conventional wool fire blanket, measures 76 by 60 in. and weighs only 2½ pounds. It is colored light grey and has the words "Fire Blanket" printed in bright red along one of its sides for immediate identification.

The fire blanket is also useful as a first aid measure in smothering fires at vents, manholes, barrels, buckets, and other containers, or as an effective welding screen.

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If Formaldehyde is one of YOUR raw materials, you can make sure of highest purity and uniformity by calling Heyden. The reliability of Heyden Formaldehyde is backed by years of research and production experience.

For a dependable source of supply—for prompt delivery—call Heyden for Formaldehyde. Formaldehyde Solution N.F. is shipped in bottles, carboys, drums, tank trucks or tank cars. 37% methanol-free grade in tank trucks and tank cars.

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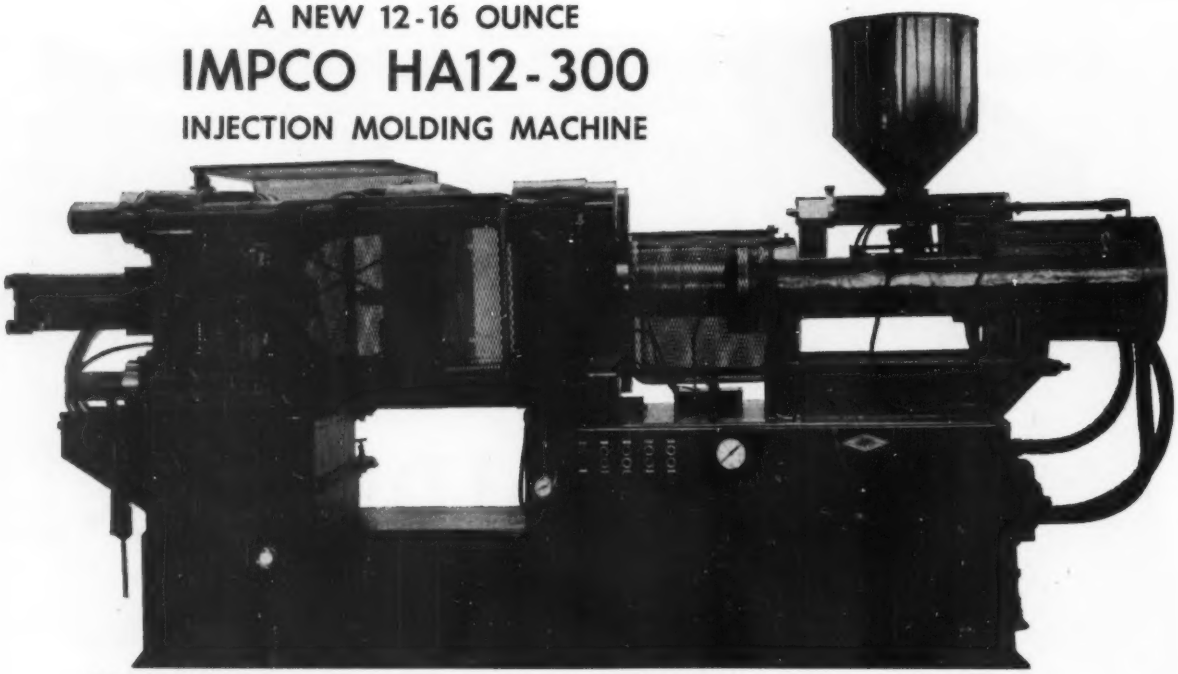
PARAHYDROXYBENZOATES • PENICILLIN • PENTAERYTHRITOLS • PROPYL GALLATE • RESORCINOL • SALICYLATES • SALICYLIC ACID • STREPTOMYCIN

A NEW 12-16 OUNCE

IMPCO HA12-300

INJECTION MOLDING MACHINE



SPECIFICATIONS:
Injection Capacity—12 Ounces
Injection Pressure (Plunger)—22,400 lbs. p.s.i.
Clamping Pressure—300 Tons Stroke—12½"
Mold Space (Between Tie Rods)—16" x 19¼"
Machine to Cycle (Dry Run)—6/minute
Dimensions—173" long—50" wide—86" high

FEATURING:
A high plasticizing, adjustable prepacking, positioning injection unit. Improved two pressure hydraulic system and electrical circuit in utilizing modern techniques. Large free area under platens with accessibility to all parts. Separate control panel, automatic lubrication and oil temperature control.

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Assures a quality of product that will more than meet conditions encountered in service.

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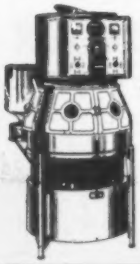
From 21 to 126 samples, depending on size, can be simultaneously exposed to the light of the Atlas Enclosed Carbon Arc. Exact duplicate tests can be repeated at any time. Temperature is controlled automatically and humidity is furnished by evaporation from a constant water reservoir. Operation of the Fade-Ometer is completely automatic, permitting the machine to be left in continuous 24-hour operation.



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Phenolic-Glass Molding Compound

A NEW phenolic molding compound having an impact strength of 12 ft. lb. per in. minimum has been developed by Durez Plastics & Chemicals, Inc. This high impact material consists of 1-in. lengths of Fiberglas rovings impregnated with a phenolic resin.

It can be molded in standard compression molding equipment. Fully positive molds are more desirable than landed semi-positive molds. The only variation from normal practice in mold design is that a substantial mold-draft must be allowed—on the order of 0.008 in. per in. of depth. If a land-type mold must be used, the smallest possible lands are recommended in order to get good thin cut-off.

Preforming

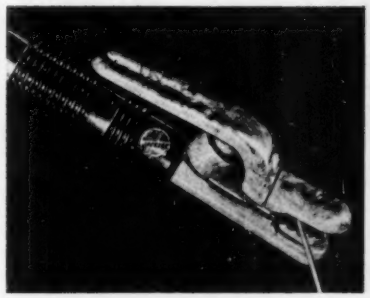
In its normal dry state, the new material requires preforming pressure of 20,000 p.s.i. with about 10 sec. dwell time at this pressure. However, if the material is exposed to steam for a few seconds, only a few hundred pounds pressure is required to produce a satisfactory preform.

Pre-Heating

The material can be pre-heated with high frequency or in a steam vapor-type oven. No more than 10 sec. exposure to steam vapor is required.

It is recommended that 3000 p.s.i. of the projected area of the molded part should be used for fully positive molds up to 1 in. of depth and approximately 3500 p.s.i. for semi-positive land-type molds. For depths greater than 1 in. the pressure should be increased by 700 lb. for each additional inch of depth. High

New compound—phenolic-impregnated glass rovings—is supplied in dry form



Welding electrode holder has insulators and spring cups of new compound

frequency pre-heated preforms make it possible to reduce the pressure requirements by 50%; other pre-heating methods allow for a 25% reduction. The material will mold well at temperatures between 280 and 330° F., with the lower temperature range being the most desirable for thick sections and to gain the greatest possible strength in the molded part. The average curing time of this material is only slightly more than that of general purpose phenolic but a breathing cycle is desirable wherever possible.

Jackson Products Co., Warren, Mich., has used this new material, called Durez 16221, in its model AW-C insulated copper alloy welding electrode holder. Four separate molded parts are used in this assembly. The material is also being molded into heavy duty brackets which support the inner shell of a refrigerator. These parts are being molded by The General Industries Co., Elyria, Ohio.

High Strength

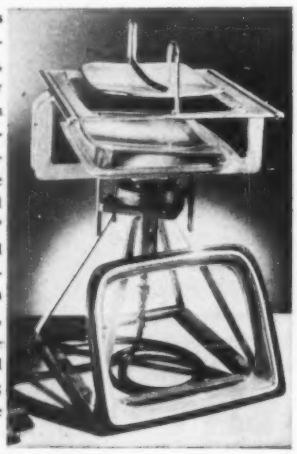
According to Durez, the strongest phenolic material available prior to their 16221 was a cord-filled phenolic with an impact strength of 8 ft. lb. per inch. Minimum impact of the new material is 50% greater or 12 ft. lb. per in.; maximum impact strength obtainable is on the order of 20 ft. lb. per inch. Tensile strength is 24,000 p.s.i. and flexural strength is 65,000 p.s.i.

This material should open new fields of phenolic applications in such items as heavy duty insulators, brackets, spring cups and holders, and other uses which were formerly closed because of requirements for extremely high-strength materials.

Cut spray decorating costs by rapidly wet painting three-dimensional parts, one color after another.

ELECTRO-FORMED METAL SPRAY PAINTING MASKS

(Made by Patented Process)



Clean, sharply defined letters and decorative effects are obtained on intricate die castings, stampings and plastic forms by accurate control of painted areas and with no fogged edges. After-wiping or buffing-off of over-spray is unnecessary. The "loose" inside of letters and numerals, such as "O" and "6," is held in position by arched bridging to eliminate objectionable "ties." Plug type masks (keep depressed areas clear, while spraying background); lip-type masks (protect background while painting depressed areas); and block-cutout, plane-surface type masks.

★ ★ ★

Foot treadle air-operated clamps, fixtures and tools which position and hold the piece snugly in the mask; and permit the operator to use both hands.

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We design, engineer and build automatic, entirely air-operated machines for spray decorating a variety of small parts at speeds of up to 3600 per hour. Eliminate the hazards of electric motors, mercury or solenoid switches and the cost of explosion-proof electrical equipment. Masks are inserted flush with top of the working table. Spraying is from below. Dials regulate cycling speed and amount of paint sprayed. The same amount of paint is sprayed on every part, regardless of speed of loading cycle. Effects paint savings of up to 50 percent over hand spraying. Employs 8 automatic guns and two 2-gallon air-agitated paint pressure tanks with four insert containers.

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It's simplicity itself! Drop your plastic, glass, metal, wood, cardboard or other items into the hopper and they come out perfectly printed at 2,500 pieces per hour. Prints one or two color decorations, trade marks, illustrations on almost any cylindrical surface. Uses inexpensive rubber stamps. Requires no skill to operate.

To demonstrate the efficiency of this unit, Apex will custom decorate substantial quantities of your pieces at very nominal rates.

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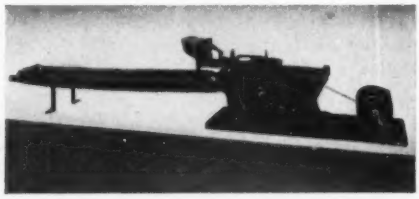

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Tape Reel

BY REDESIGNING a molded styrene reel used in a magnetic tape recorder, Minnesota Mining and Mfg. Co., St. Paul, Minn., has improved the operation of the recorder and reduced to a minimum the possibility of reel warpage.

The new three-spoke reel, which contains 45% more plastic than did the previously used model, is molded by American Molded Products, Chicago, Ill., with wider and heavier spokes. As a result of this increase in size, the 7-in. reel is sturdier and less likely to bend out of shape.

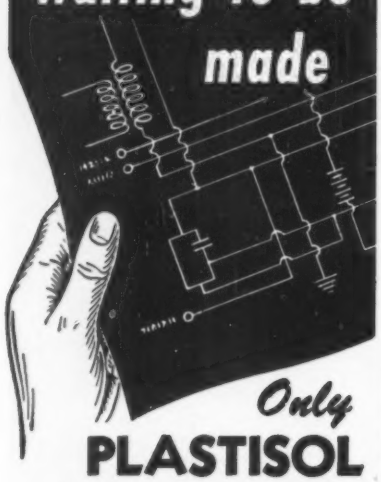
Increasing the spoke width offers another less obvious advantage. Since many users of tape recorders are in the habit of jotting down the subject matter of the recording directly on the reel itself, the wider area of the new smooth-surfaced styrene spokes provides a larger, easier-to-write-on labeling space. In addition, the trademark and other data, which previously had appeared as raised letters that hampered writing on the top surface of the spokes, are now molded directly into the bottom surface.

When the recorder is in use, the increased diameter of the hub of the reel serves to reduce winding tensions near the end of the recording and to keep the tape speed uniform. A special "V" slot molded-in one side of the hub is used as a guide for threading the tape, thereby reducing the time normally required for that job.

The attractive reel is molded of crystal styrene supplied by Koppers Co.

Redesigned styrene tape reel has molded-in "V" slot for easier threading

ELECTRICAL
For products waiting to be made



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for Molding, Extruding or Dipping can be specifically compounded to produce these advantages:

- Ease of molding or coating—inexpensive molds or equipment required
- Good aging properties under normal operating temperatures
- Low temperature flexibility
- Good outdoor durability
- Resists most acids and alkalis
- Good flame resistance
- Resistance to oil and grease

Whatever you manufacture, from spaghetti wiring to circuit-breaker panels, Stanley chemists can formulate a vinyl plastisol to meet your most exacting insulation requirements. For specific information write *today* to the Stanley Chemical Co., 72 Berlin St., East Berlin, Conn.

Industrial Coatings
STANLEY CHEMICAL
LACQUERS JAPANS SYNTHETICS ENAMELS

Vinyl Upholstered Toilet Seat

SOFT, cushiony toilet seats, upholstered in 20-gage vinyl, represent a radical departure from conventional hard and rigid seats in use today.

The seat, a product of National Sanitary Products Corp., Ridgefield, N.J., is of simple three-part construction, consisting of wooden base, foam padding, and an attractive and utilitarian covering of Duran vinyl sheeting.

As the initial step in assembling the seat, a rectangular piece of vinyl sheeting, pre-shaped by vacuum forming, is fitted into a special mold built to the curves and contours of the finished product. Foamed rubber, which is supplied to the manufacturers already cut to the desired shape and size, is then laid directly into the formed vinyl sheeting, and a flat, wooden base, also machined to the conventional seat shape, is placed on top of the foam. Finally, another piece of sheeting, which serves as the bottom half of the seat covering, is smoothed on over the wooden base.

The complete unit is then passed along to an electronic sealer where the top and bottom pieces of sheeting are bonded together around the inside and outside circumferences of the seat. Excess material, both from the outside edge of the seat and from its center, is removed by cutting it away.

The wooden cover, which is joined to the seat by chrome hinges, is upholstered in a similar fashion. Two large pieces of the sheeting are laid on each face of the cover and electronically sealed together along the outside perimeter.

From the standpoint of practicality, the choice of vinyl sheeting to upholster the seat has resulted in a more comfortable, durable product. The vinyl upholstery is pliable under pressure, it will not crack or peel under ordinary use, and it is easy to keep clean.

From the standpoint of attractiveness, the smooth vinyl-covered seat is a handsome addition to the bathroom. The sheeting is finished in a striking mottled effect and is available in 7 different colors to blend with the decor of modern bathrooms.

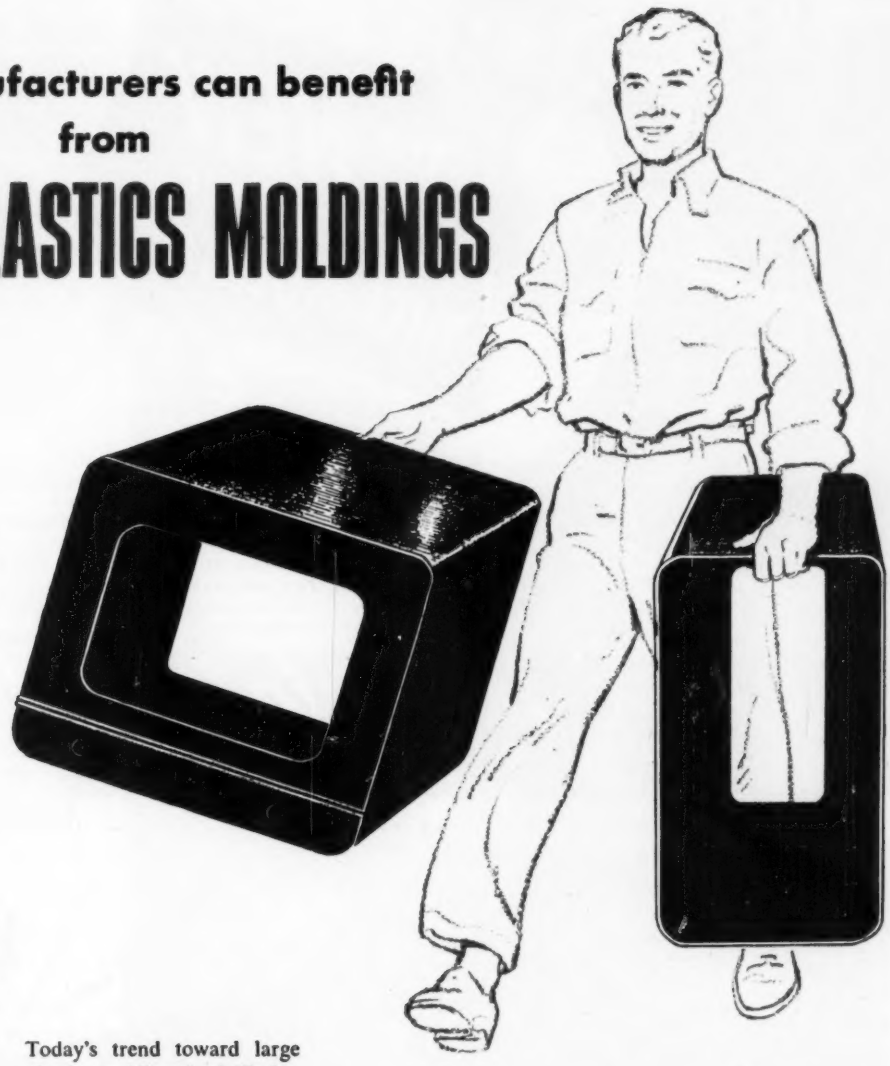
Top and bottom vinyl sheet for seat is sealed electronically (left foreground)

Cross section of seat shows wooden base, foam rubber, and vinyl sheet covering

Holes for fastening hinges to seat and cover are drilled with part in jig

How manufacturers can benefit from

LARGE PLASTICS MOLDINGS



Today's trend toward large plastics moldings is vitally important to manufacturers of television sets, air conditioners and other BIG items. Here's why:

1. Plastics meet the consumer demand for products which are attractive—and *stay* attractive . . . which are easy to clean and move about . . . which resist corrosion, stains and rough usage.

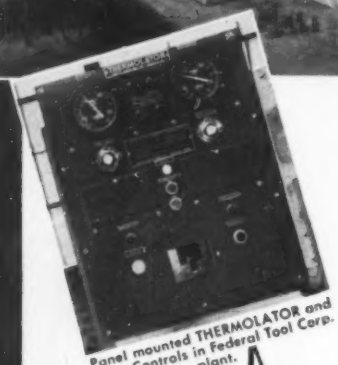
2. Plastics offer manufacturers a moldable material with almost unlimited design possibilities. Furthermore, plastics parts can be mass-produced quickly and economically. Often savings from plastics can be reflected in lower unit costs for broader markets, or in product improvement.

Why not take advantage of this trend by using plastics for *your* product? General Electric is a supplier of top-quality phenolic and polyester molding materials that provide the excellent surface finish, strength and dimensional stability you'll want in the parts you buy. G-E compounds offer your molder fast molding cycles and long flow characteristics for rapid production. For more information and help in the application of these materials, write to: *General Electric Company, Section 314-6A, Chemical Division, Pittsfield, Massachusetts.*

P.S. TO MOLDERS:
Have you tried G-E Molding Compounds 12853 and 12876? They are supplied in soft flows especially designed for molding large parts. Ask about them.

G-E Phenolic and Polyester Molding Materials

GENERAL ELECTRIC



Panel mounted THERMOLATOR and Press Controls in Federal Tool Corp. plant.

THE NEW AUTOMATIC THERMOLATOR*

*REG U.S. PAT OFF

MOLD TEMPERATURE CONTROL UNIT WITH PANEL MOUNTED CONTROLS

- **AT-A-GLANCE VISIBILITY OF CONTROLS**
  Big Thermometers and pilot lights give instant check on operating conditions.
- **PUSH BUTTON START • QUICK HEAT-UP**
  With dials set for desired temperature, Starter Button begins operations, with large capacity auxiliary heaters aiding fast heat-up of mold.
- **MOLD TEMPERATURES AUTOMATICALLY HELD WITHIN ½°-F**
- **OUT-OF-THE-WAY INSTALLATION OF UNIT**
  Control on panel; Relay Box where convenient; THERMOLATOR unit at either end of press, or behind it, out of traffic pattern.

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using the NEW AUTOMATIC THERMOLATOR with remote controls to make adequate supervision easier and faster, as in Federal Tool Corp. plant in Chicago.

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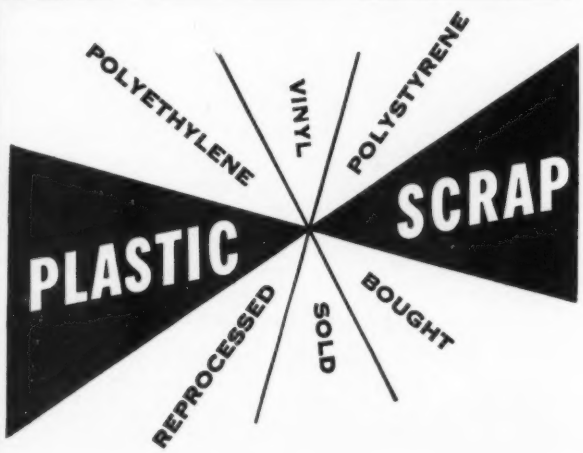

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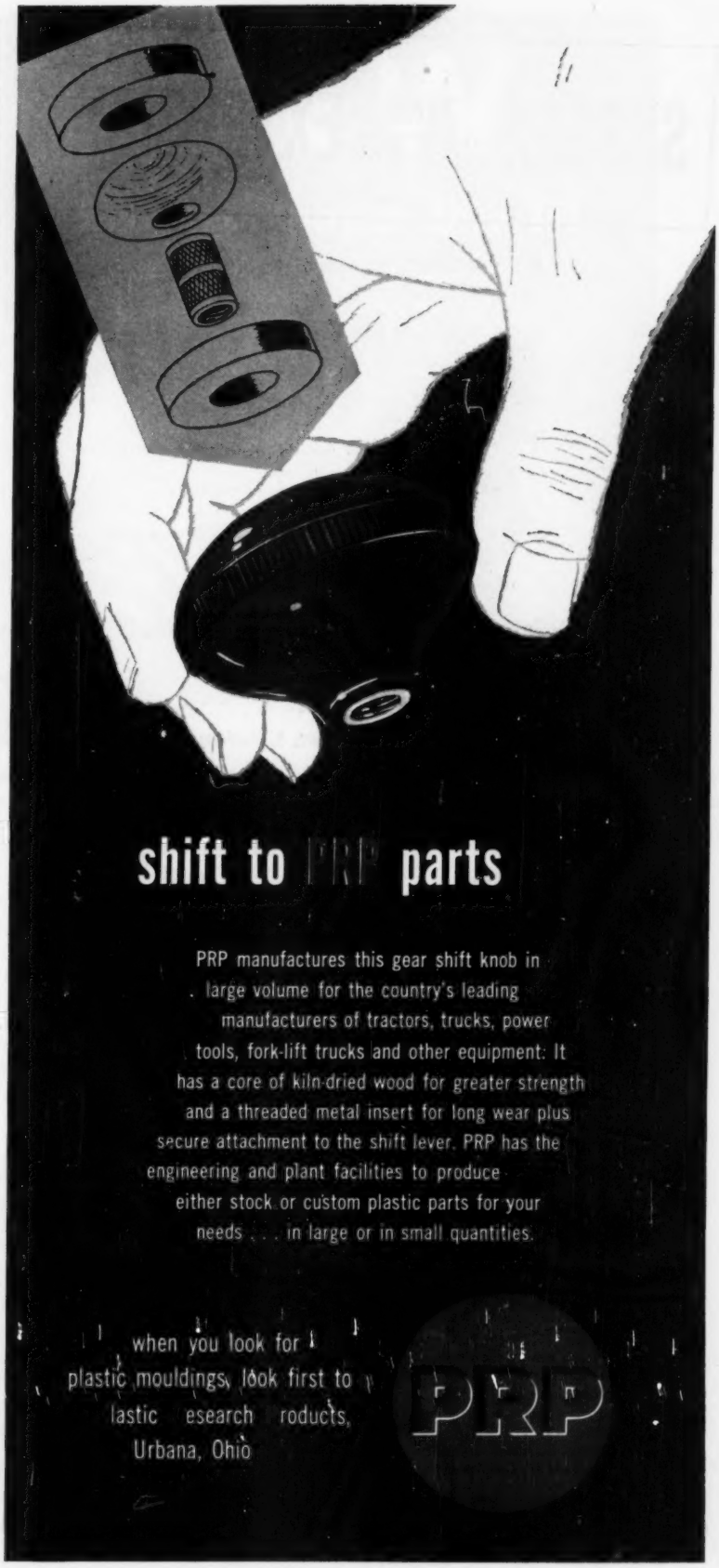
The rugs, manufactured from Vinylite material by Vinyl Linens, Inc., New York, N. Y., combine the advantages of being easy to keep clean with long wear and attractive design. In normal use, the mats will not scuff, tear, crack, or lose their texture; they will resist soaps, water, detergents, oils, greases, foods, and most chemicals; they will not skid on polished surfaces; and their resiliency coupled with their deep-weave patterns adds up to greater foot comfort.

The rugs are embossed in nine different textures, based on hooked, rope square, and braided rug patterns, and are available in twelve colors. In addition to their use as floor mats, the new rugs make excellent door mats and throw rugs for bath houses on boats.

Embossed deep-weave carpet texture of vinyl rugs contributes to room decor



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Corrosion

(*Continued from pp.* 83-89)

resins, has the desirable feature of a sheet membrane lining. Upon drying, it forms a film thickness about four times heavier than the No. 40 coat, identical to it in composition and range of chemical resistance.

Nukem also produces anti-corrosive membranes, including Nuran linings, which consist of a vinylidene chloride compound combining the more desirable characteristics of rubber and plastics, and Koroseal (plasticized polyvinyl chloride) linings.

Protective Membrane

Baked vinyl type coatings supplied by A & P Finishing & Mfg. Co., Melvindale, Mich., are smooth, tough non-hygroscopic coatings possessing excellent adherence and high chemical resistance. TP-100 is generally used as a thick protective membrane on plating racks, dipping baskets, conveyor hooks, etc., while TP-110 is specially formulated for use on large equipment such as duct systems, centrifugal fans, tanks, etc. Both can be applied in thicknesses ranging from 10 to 100 mils. They are also characterized by excellent dielectric strength and insulating properties.

A & P's TS-120 is a phenolic-base material which produces a hard, durable, corrosion resistant coating or lining on food, chemical, and pharmaceutical processing equipment. Its properties include non-toxicity, good dielectric strength, excellent adherence, and high resistance to a broad range of chemicals, coupled with temperature resistance up to 325° F. TP-500, consisting of selected polyvinyl resins modified and compounded with other ingredients, can be applied as a protective coating or lining in the form of calendered or press-polished sheeting, extruded tubing, solid cord, channel, in molded form, or as a plastisol. Its elasticity permits thermal expansion and contraction without rupture, making it suitable for mobile equipment.

In the application of such coatings, proper preparation of the surface is of prime importance. This includes the removal of sharp edges, weld spatters, etc., followed by sand blasting the surface to insure a per-

manent bond. The final step consists of the actual application by air-spraying, flame-spraying, dipping, brushing, or vulcanizing.

Saran Protective Coatings, Inc., Ferndale, Mich., includes among its group of coatings the Sarancote 700 series and Pliogard, an acid- and alkali-resistant rubber base coating. Sarancote 700 is applied to ferrous or non-ferrous metals, following application of a specified metal conditioner or primer by brush or spray. Pliogard, which is formulated with a copolymer of styrene and butadiene, produces films which are exceptionally tough, hard, and chemically inert.

Ric-Wil Plastic Coating & Mfg. Co., Cleveland, Ohio, applies specialized corrosion-resistant coatings to various types of industrial equipment in a new plant at Salem, Ind. Operations at this plant include the spraying of pipe on the inside in lengths up to 50 ft. and baking the coatings in a specially designed oven. Oil well drill pipe, when treated by this method, is said to last approximately five times as long as uncoated pipe in the sour crude oil fields. Ric-Wil also applies tank coatings for storage of water and chemicals and coats duct work.

Ricwilite 7100 is a corrosion-resistant cold-setting phenolic resin coating for certain corrosive conditions and equipment where the use of a baked-on coating is impractical. It offers high resistance to strong acids, alkalies, and solvents. Polymerization takes place at room temperatures through the addition of a catalyst just prior to application. Flexibility of the dried coating is such that it will not crack or flake if bent 90° over a ½-in. mandrel; the coating will not crack, craze, or lose adhesion if subjected to a temperature change from 500 to 32° F. in three seconds. Ricwilite 1060, a cold-set, baked-on phenolic coating, polymerizes at 350 to 400° F.

Phenolic Coating

The formulation and application of baked-on and catalytically polymerized phenolic coatings for drill pipe, tubing and sucker rods, and other items used in the petroleum industry is the specialty of Permolite, Inc., Dayton, Ohio. The Permolizing process is said to increase the life of the pipe by as much as seven times. Coating thicknesses are held

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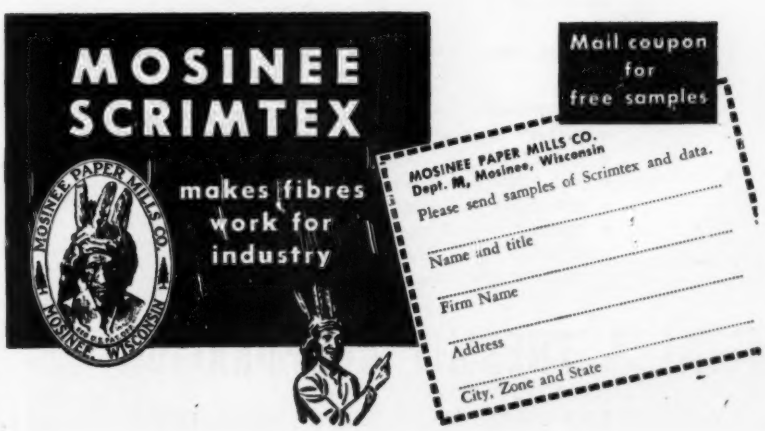

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Thermolite-31 is thoroughly compatible with the vinyl system. Where absolute clarity and transparency are required, this new stabilizer is particularly suited. Heat sealing and printability characteristics are excellent in materials stabilized with Thermolite-31.

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within a tolerance of 0.006 to 0.008 inches. Surface preparation includes sand blasting before application of the coatings.

Protective coatings and linings produced by U. S. Stoneware, particularly designed to combat corrosion, include the Tygon series of paints, based on vinyl; Duralon (furane based) finishes for porous surfaces such as plaster, concrete, brick, wood, etc.; and Tygon and Tygoflex tank linings. Tygon tank linings are made in the form of press-polished sheeting 3/32 or 3/16 in. thick, while Tygoflex, a vinyl plastisol, extends the protective properties of vinyl to intricately shaped equipment. It is applied in liquid form by dipping, casting, brushing, or troweling, then is fused by heat into a tough, flexible heavy duty coating. Thickness can be varied from 1/10 to 1/4 in. per application.

Fortified Silicone

Silicones and vinyls are among the plastics used in protective coatings made by The Dampney Co., Boston, Mass. The silicone type coating is fortified by pigmenting the basic silicone resins with aluminum and extended with selected modifiers. The coating is ideally suited for use in contaminated atmospheres and is recommended for service at temperatures ranging from extreme cold to 400° F. for continuous exposure, and for periodic fluctuations as high as 600° F. It may be conveniently applied by brush or spray, drying to a tough film within half an hour under good conditions.

Since 1935, phenol-formaldehyde coatings have been formulated and applied by Heresite & Chemical Co., Manitowoc, Wis. Complete polymerization of the Heresite baking-type coatings is attained. The various layers of the coating are fused together during the baking process to form one homogeneous film. Coating thicknesses are varied in order to meet the particular corrosive conditions.

Typical examples of products in which Heresite coatings are used to impart corrosion resistance include aluminum rayon spinning bobbins, buckets and godet bearings, steaming trays, filter press plates and frames, tanks, heating and cooling coils, fans and blowers, piping, boiler water purification equipment,

tank cars and trailer truck tanks, as well as steel shipping containers.

Excellent resistance to corrosive conditions is an important feature of the Pype identification system developed by Wilmington Plastics, Inc., Wilmington, Del. This system makes use of pre-printed labels of rigid vinyl sheeting which snap directly on different sizes of pipe, immediately identifying the type of material each pipe is carrying. The snap-on feature of the labels, plus the fact that they require no additional protective coating against corrosion or chemical attack, makes them useful for large plant installations.

Plastics Tapes

The important role being played by plastic tapes—particularly vinyl- and polyethylene-backed tapes—in preventing corrosion of both overhead and underground pipes was pointed out in the May 1953 issue of MODERN PLASTICS, p. 73*ff*. The resistance of these tapes to corrosive influences, their conformity in a tight wrap, and their ease of application by hand or with special tape-wrapping equipment, are among the reasons for their rapidly increasing use.

One company has estimated that, within the next two years, some 31,000 miles of pipe line will have been protected with plastics tape. Corrosion is the deadly enemy of pipe lines, but a dry pipe will not corrode, and tape is one of the best methods of achieving this result.

The estimate of an annual loss of $600 million caused by corrosion of buried pipe is not the whole story. In addition, as a result of such corrosion, huge amounts of gas and petroleum products escape into the ground from perforated pipes. There is a record of one 40-mile gas distribution line so badly corroded that 90% of the gas which entered it was lost through perforations in the pipe. Fires and explosions caused by the leakage of flammable materials are always a hazard, while oil leaking from a pipe may contaminate a city's entire water supply.

In this far-flung and highly specialized problem, no single type of plastics tape, coating, liner, or fabricated equipment can provide the answer to every installation. The fact remains that plastics, thanks largely to new materials and techniques, are now really coming into their own in this field.—END

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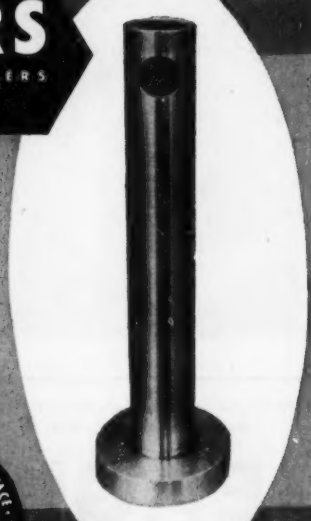

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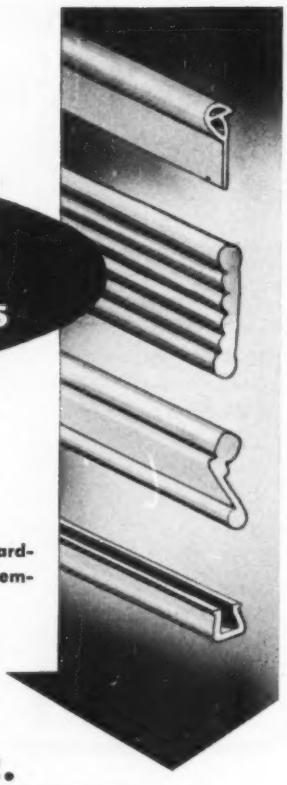

Pyramid excels in the production of special shapes in Vinylite and Geon.

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Plastics Armor

(*Continued from pp.* 93-95)

tary specifications are available for the evaluation of aircraft reinforced plastics armor plates. It has been necessary, therefore, to use the ballistic properties of the 24S-T Dural Armor Plates as the standard for comparison under the same firing condition. In all tests, military ammunition was used; standard .30 caliber, muzzle velocity about 2400 ft./sec., fired at a 50-yd. range with a Browning aircraft machine gun.

Preliminary results of our basic program indicate that newly developed glass laminates are equal to 24S-T Dural for armor plates, with considerable savings in weight and cost.

Naturally, exhaustive tests will still have to be conducted before reinforced plastics will be approved as a substitute for metal armor plate for aircraft. It is a challenge to the reinforced plastics industry, but a challenge that has been accepted with the usual full cooperation and generosity that has always been displayed by the members.

Pottings, Adhesives

(*Continued from pp.* 95-96)

through a small hole in the tube, using sufficient pressure to expand the diameter of the thin walled tube approximately 0.005 inch. If the expansion is uniform around the circumference of the tube, it can be measured with a micrometer and thus the inspector can be reasonably certain that the joint has been completely sealed.

In addition to this rather simple method it will also be necessary to statistically sample and test by destructive methods a sufficient number of joints to guarantee a high degree of confidence. Additional inspection methods such as the electronic Probalog and use of ultrasonics may prove feasible.

The use of potting compounds and adhesives in rockets and guided missiles could reach a rather large production figure if properly developed. The use of even ¼ lb. of potting material in a solid propellant rocket could easily consume a million lb. during the course of a production program.

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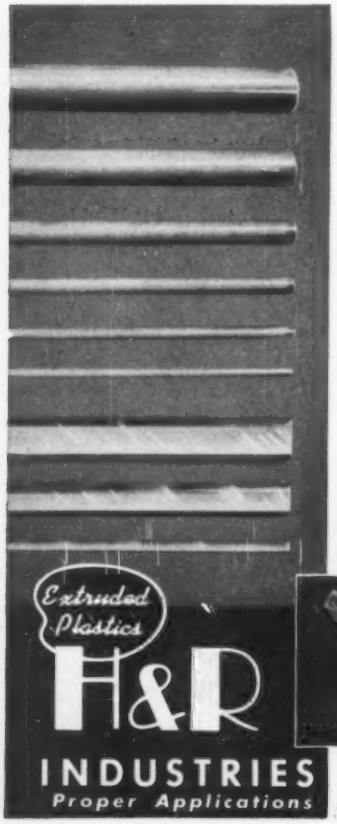

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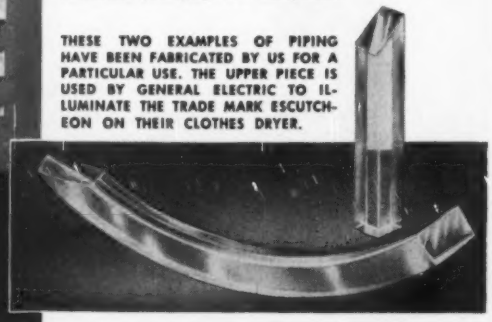

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INDUSTRIES
Proper Applications
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Structures

(*Continued from p. 96*)

dition, without the use of special equipment.

These characteristics are reflected all through engineering and tooling, with the result that only about 20% of the engineering man hours are required to design a reinforced plastics structure to meet the same specifications and requirements as a metal airframe, provided the engineer has adequate knowledge of plastics materials.

Some 10 years ago, reinforced plastics materials found their way into aircraft in ducts, manifolds, and interior parts that could not be made economically from other materials. The performance of these parts led to the use of reinforced plastics on an ever widening scale. Radar antennas had to be housed in radomes. Electronic requirements are such that the most efficient economical material to use was found to be reinforced plastics. Thus, over a period of about ten years, search domes and gun laying domes were developed utilizing glass cloth impregnated with polyester resins. For strength and weight requirements and to provide the best radar transmission efficiency, reinforced plastics honeycomb core materials were developed. Radomes have been designed for as much as 25 p.s.i. surface pressures, to withstand loads imposed by 2-in. hail stones encountered at the cruising speed of the aircraft and to withstand the gun blast pressures of 20-mm. cannons. Aircraft designers no longer consider radomes as secondary structures, because in so many cases their damage or loss in flight could result in the loss or malfunction of the aircraft or missile.

Electronic requirements in several large bombardment type aircraft have necessitated the use of reinforced plastics materials as part of the primary structure of the airplane. In some cases, almost entire sections of the aircraft are electronically isolated from the rest of the structure by the use of large reinforced plastics structures as insulators. In such cases, the bending, shear, torsion, and local loads are carried from the isolated metal structure—which is serving as an antenna—by the reinforced plas-

tics structure to the rest of the airplane.

The actual number of reinforced plastics components that have been used successfully on aircraft cannot readily be determined. However, it is estimated that Zenith has made 100,000 fin and wing tips—about 50% of those used on military aircraft, and almost 75,000 radomes—about 60% of those used on military aircraft of the United States. There have been practically no failures in service other than those normally encountered in the life of an airplane. These parts and others are to be found in such aircraft as Lockheed's Neptune P-2V, Constellation W-V2, McDonnell's Banshee and Demon, Convair's Sea Dart XF2Y-1, the F-80, F-84, F-90, F-94, B-47, B-52, B-36, and many other well known aircraft.

At the present time, fuselage sections for a large airplane are being produced at the rate of two a day by this company. They are 17 ft. long, approximately 6 ft. high, and 3 ft. wide. No stringers, bulkheads, or rings are used in this structure. It is a monocoque honeycomb core structure that has withstood almost 300% of ultimate design loads in static tests.

Convair's Sea Dart XF2Y-1, the Navy's delta-wing water based fighter, utilizes reinforced plastics parts that are subjected to high loads and elevated temperatures. This airplane's continuous exposure to sea water and other extreme climatic conditions proves again the advantages of reinforced plastics over other materials.

Lockheed's Super Constellation laboratory also illustrates the application of reinforced plastics materials to highly loaded important parts of a modern airplane. In Lockheed's Sky Sentry, which is a Super Constellation and is similar to the Navy's new W-V2 radar plane, huge reinforced plastic parts are used. It is a well known fact that this airplane cruises at a speed in excess of 300 miles per hour. The shark-like fin atop the fuselage is about 15 ft. long, 8 ft. high, and 5 ft. wide. The extended belly of the fuselage is approximately 29 ft. long, 20 ft. wide, and 7 ft. deep. This is the largest airborne radome ever built. The tanks on the wing tips are used to carry extra fuel and are similar to tanks now being developed for fu-

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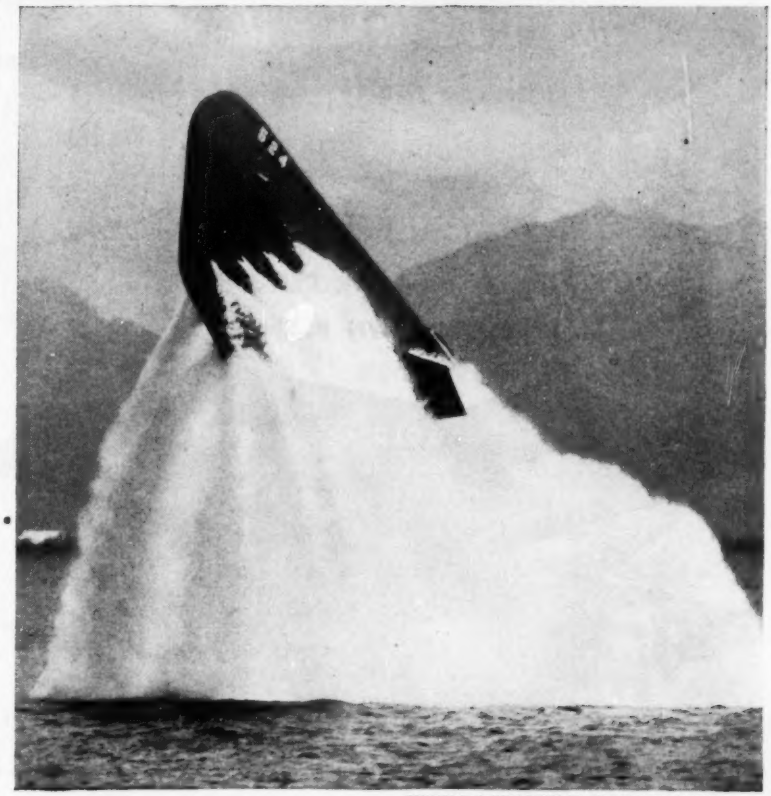

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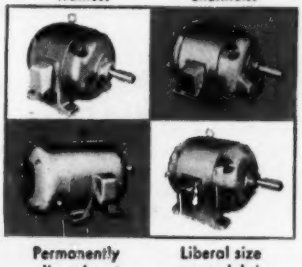

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ture production to supply the United States Air Force. The use of reinforced plastics materials for such tanks provides the advantages of low cost and the use of non-critical materials that cannot be reused should they fall, after being jettisoned from our aircraft over enemy territory.

The reinforced plastics parts on the Constellation, on Convair's Sea Dart, and on numerous other aircraft are indicative of things to come, directly stemming from present day manufacturing, design, and thinking. Future designs—those with even more complex requirements—can take advantage of the characteristics of the new phenolic resins. It is anticipated by many that, in the near future, supersonic aircraft and guided missiles will utilize these new materials for primary structures in combination with metals and other materials to provide our services with safe, efficient, and more economical equipment.

Moderator's Summary

Today almost every branch of the armed forces as well as the aircraft companies, plastics material suppliers, fabrication companies, and a host of research organizations are actively engaged in development of the common goal to utilize plastics materials to their fullest advantage —as a primary airframe construction material.

The impetus behind the initial trend toward structural components was the demand for efficient electronic equipment such as radar and radio antenna installation which have become an absolute necessity on modern aircraft and guided missiles.

The logical result of this research is now beginning to assert itself in the increasing number of structural applications unrelated to electrical properties but taking advantage of the ease of fabrication, the inherent airfoil smoothness, and the corrosion resistance, and which will compete directly with metals on a strength-weight basis, particularly at elevated temperatures.

Thus, the plastics industry is firmly entrenched in the aircraft and missile field—well supported by sound research programs for improved materials and fabrication techniques and more comprehensive design data.—END

Vinyl Acetate

(*Continued from pp.* 103-105)

possibilities in other resins have failed to stop research and development in PVAC emulsion paint. It is a certainty that many of the large paint company researchers are working either with a straight PVAC emulsion or some type of copolymer such as vinyl chloride-acetate for both exterior and interior use. Many of them were stung by premature introduction of unsatisfactory "new" paints in the past and the next time they want to be more sure of their product before an official announcement of its availability.

The total amount of synthetic resins used for surface coatings in this country is over 500 million lb. a year out of a total 2 billion lb. synthetic resin production. Almost every resin producer yearns for a big share of that market.

Paint Possibilities

Up to now, two types of vinyl acetate paint have made good headway in the United States. PVAC emulsion primer paint for application on plaster walls, old painted surfaces, wallpaper, wallboard, interior masonry of any type, and water-mixed paints have won approval. The great advantage is that it will seal and dry completely within 20 min. to 2 hr., thus permitting quick application of a finishing-type paint without waiting a day or two for the undercoat to dry.

PVAC emulsion is also beginning to make progress in this country as an exterior paint. Many carloads of emulsion are shipped for this purpose every month.

A California company has sold thousands of gallons particularly for use on stucco, stone, or concrete. It can be applied on stucco without waiting a month for the stucco to cure. Its film structure lets the moisture out of the wall without causing the paint to bubble or blister. This property has been ascribed to PVAC's hydrophilic roots which adhere to the stucco and also because it is not affected by alkali. Furthermore, PVAC emulsion is noted for its adhesiveness and for its better light-fastness. In California and Florida, where stucco houses are most common and the sunlight is strong, the PVAC emul-

sion is therefore highly desirable.

This reporter's estimate of the situation is that PVAC emulsion paint has definite great potentiality as a primer. It looks highly promising for big volume use as an exterior paint for stucco, but needs more testing before it can prove superiority over other types of exterior surfaces. It will not be a serious competitor to "water-based" or "rubber-based" interior paints until the price of PVAC emulsion comes down or glamor of the highly publicized "rubber" paints wears off. Nevertheless, PVAC still has definite possibilities in this interior paint field for some time.

The matter of price is puzzling. Styrene-butadiene water or rubber paint is made from styrene monomer that sells at 21¢ a lb. and butadiene at around 18 cents. The finished copolymer from which the paint is made sells at 31½¢ a pound. Yet polyvinyl acetate for paint, which is derived from what was recently 18¢ vinyl acetate monomer, sells in the high thirties or low forties. There is room for speculation on what this situation means to the future of vinyl acetate paint, especially since the price of vinyl acetate monomer has started to decline and it is likely that butadiene prices will increase when and if the government plants are sold.

The paint situation for PVAC resins has been emphasized here both because of its great uncertainty and its great potentiality. It is a major factor in the great guessing game now going on to determine the future volume of PVAC production and is typical of many other possible PVAC applications.

In Textiles

Another great uncertainty is the potential big volume use of vinyl acetate derivatives in the textile industry. The future looks promising, but is beclouded with shadowy hopes and desires that may flit away before achieving permanency.

The textile finishing field is another where nearly all kinds of synthetic resins are used. In most cases only a small amount of resin is needed. The thermosets or other chemicals have taken over in most part the shrinkage, wrinkle, and crush-resistant jobs. The thermoplastics, PVAC, polyvinyl butyral, styrene, and the acrylates are all used as a surface treatment to give "hand." Butyral at around $1, compared to around 40¢ for PVAC on a solids basis, is not a severe competitor, although in such specialty applications as an impregnation for nylon parachute webbing, where it gives abrasion resistance, butyral is supreme.

The "hand" that PVAC gives to cotton goods must be seen in comparison with untreated goods in order to be appreciated. But great as that difference is, a long time is required to educate the housewife to its excellence.

If the greatest amount of stiffness with the least amount of solid resin or cost is desired, PVAC emulsion will assertedly do the work better than other thermoplastics and will leave no odor. The "stiffness" is not stiff like a board, but is a sort of quality-like character built into the goods that gives richness of texture. The polyvinyl acetate may be used in either plasticized or unplasticized form. In the latter case, it has an advantage over styrene since it will dry down to form good continuous film, while the styrene will dry in

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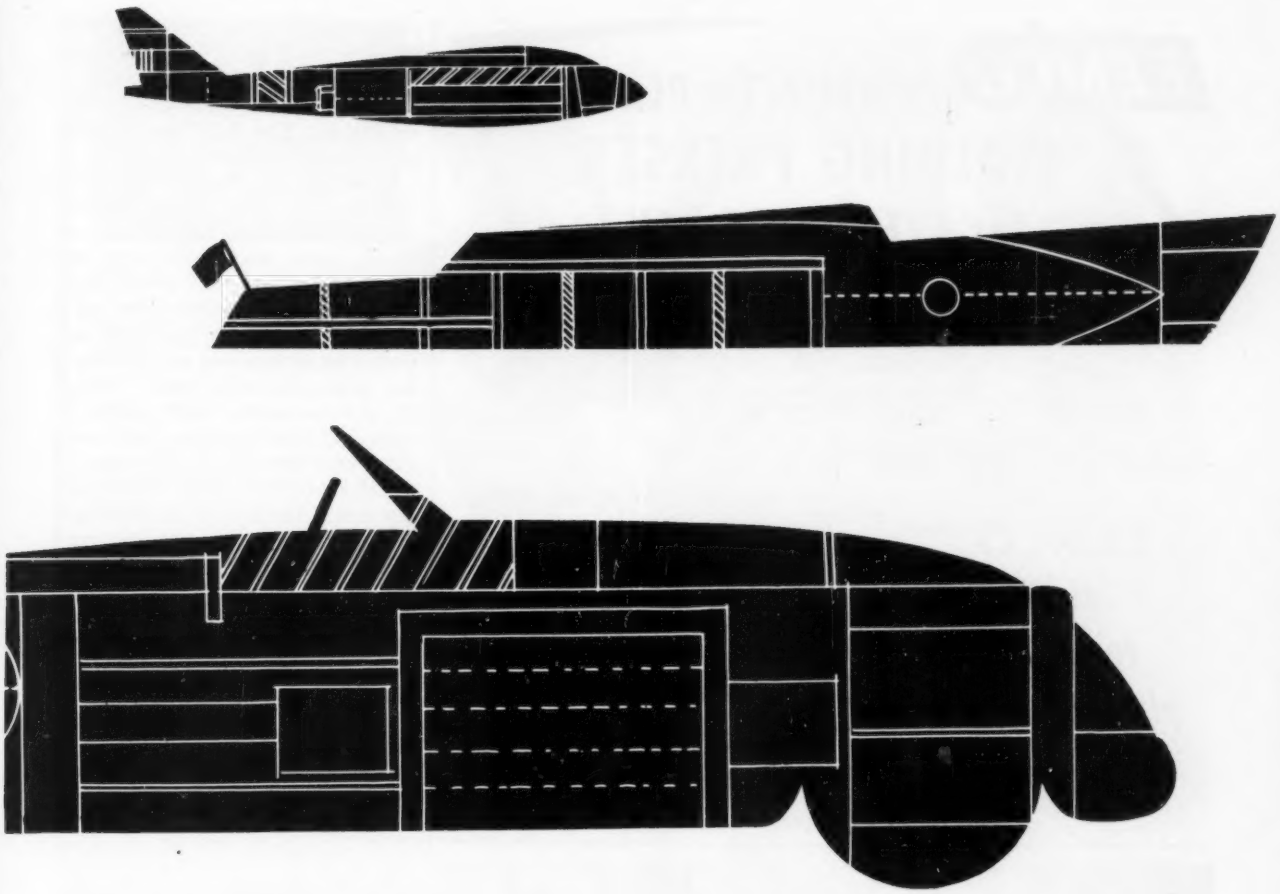

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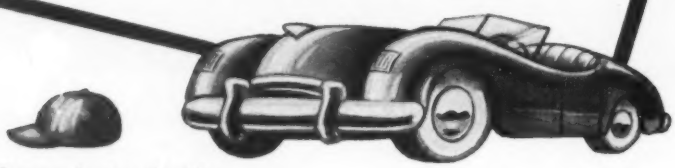

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particle form unless plasticized. The process is largely a dipping and squeezing operation. The result is roughly similar to a starching process, except that the PVAC treatment is more durable.

The principal market for this treatment is woven cotton fabrics, chief of which are tablecloths, bed sheets, grain bags with print designs, low-priced yard goods, napkins, and handkerchiefs. The ultimate yardage to be expected for treatment is between one half and one billion out of a total 7 billion yd. of woven cotton fabric produced annually. The dispersion bath contains only 3% PVAC emulsion or about 1 to 1½% solids. Estimators say that if the goal of ½ billion yd. for synthetic treatment is ever reached, it would require about one million lb. of solid resin a year. There is a possibility that vinyl chloride or some other resin may move into this field, but PVAC is now fairly well established.

There are other possibilities in this field. Denim, for example, which has graduated from a man's overall material to become popular in many classes of women's wear, will take the PVAC treatment with marked success. It has been noted that women nearly always buy starched in preference to unstarched denim, but the presently used vegetable starch washes right out. A more permanent PVAC treatment would seem logical, but up to now the weavers have not been willing to add the slightly extra cost. Something like 1½ million lb. of resin could be used in the denim market if it should switch over completely to PVAC emulsion.

PVAC emulsion is, of course, used for this same type of finish in high-style cotton dress goods, but that market is comparatively small, considering that such a small amount of resin will process so many yards of goods. It is not used to any extent in cellulose acetate goods (rayons, etc.) or in wool. There is considerable difference of opinion as to its value for use with the new acrylic and polyester fabrics, although at least one producer sells it as a sizing material for them.

Stiffening Fibers

Other kindred uses in textiles to those named above are: with thermosets and thermoplastics where

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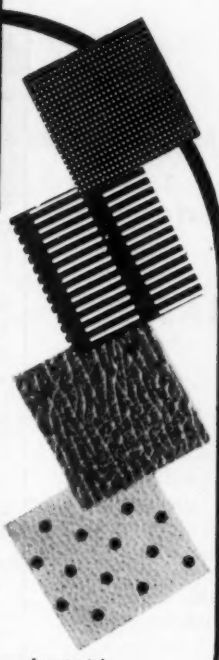

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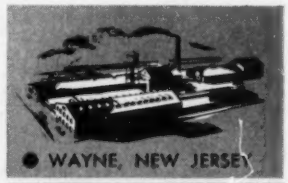

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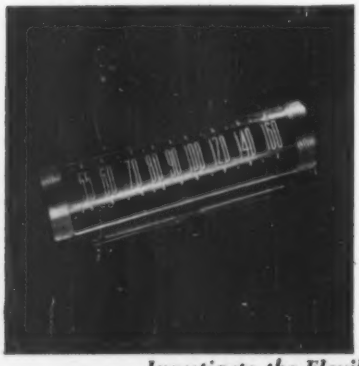

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PVAC is used to improve their adhesion to fibers and also to give stiffness to such things as inner linings used for padding in men's and women's suits; in backing for upholstery to help prevent ends from fraying out; with other resins in cotton marquisettes or curtains; and with knitted net rayon, although it is not recommended for net nylon. Still another use is for binding and stiffening agents in felt and straw hats.

If most of the above-mentioned applications should become standard, the use of polyvinyl acetate in textile finishing would perhaps double the million lb. total for treating cotton woven goods in the table cloth, bed sheet, etc. classification.

Other Textile Uses

Something like 80% of all nylon hose are sized with PVAC emulsion because it gives body and snag resistance. Ability of the PVAC to exhaust from the dye bath and to adhere to nylon is the important property.

Because PVAC emulsion produces a high strength, flexible adhesive without the necessity of using organic solvents, it is especially effective for cohesive gauze bandages. It is applied by dipping, followed by drying in ovens. A relatively high plasticizer content is used so that the gauze will stick to itself but will remain non-adherent to human skin.

When mixed with water-soluble resorcinol-formaldehyde resins, PVAC increases adhesion of synthetic latex films to synthetic fibers and thus becomes useful for bonding synthetic yarns and especially for pre-coating such yarns before rubberizing.

Many experiments are under way for the further use of PVAC emulsion as a finishing material and for PVAC as a sizing material in the textile industry, with the latter particularly effective in treatment of rayon cord for auto tires, but in very few cases is there a positive determination that PVAC will be the eventual choice.

As a binder for unwoven fabric, PVAC emulsion still leads the procession, although processors claim they are still experimenting with almost every known resin and have not yet found the exact combination they want to give strength, "hand,"

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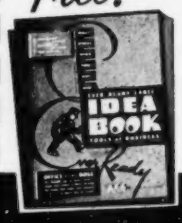

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soap resistance, and printability. At present PVAC is thought to be used as the binder in about 80% of the unwoven fabric that is currently produced.

This outlet could eventually blossom into a nice volume if PVAC holds its position against possible inroads from polyvinyl chloride. After 10 years of slow progress, unwoven fabric is beginning to show signs of much faster expansion. Originally boomed as a miracle product, it failed to "miracleize" and most of the products such as disposable napkins, handkerchiefs, and laminate filler are still in comparatively small volume production today.

Big Volume Under Way

But one of the original producers apparently thinks he has overcome his problems with a new method similar to that used in gravure printing, and is opening a new plant near Chicago with plenty of room for expansion; several new products of big volume potentiality are under way. Largest volume at present is thought to be the covering for sanitary napkins. Among others is a possible backing material for vinyl-coated fabric which would permit stretching similar to the jersey material now used for elastic backing. Such material does not deform after stretching and has many other advantages. It could also be adhered to a wall with ordinary wallpaper paste.

These examples are cited to show that unwoven fabrics have again become a very lively prospect for expansion into many fields. Eventually perhaps even those paper shirts and suits so often predicted will become realities. But the question insofar as PVAC emulsion is concerned is whether or not it will be the favored resin. Its poor resistance to soap is one thing that may have to be overcome, although for one-time applications soap is no problem.

Use of polyvinyl acetate in the synthetic fiber field is another possibility. Much experimental work has been done with it as a copolymer with acrylonitrile in fibers, but no commercial fiber of this sort has yet been officially announced in the United States. Chemstrand has reportedly used small quantities of PVAC as an aid in dyeing acrylonitrile fibers but will make no comment on plans it has made for the future.

In Paper

Polyvinyl acetate has just as many diverse possibilities in the paper field as it has in textiles, but most of them are related to its use as an adhesive and with polyvinyl alcohol which will be discussed in a later article.

Among those uses with paper not directly involving adhesives is a vinyl acetate copolymer for coating wallpaper to resist dirt and ink; a PVAC coated paper for miniature sugar bags which allows them to be heat sealed around the edges; cardboard greaseproofed with a PVAC coating but which must be handled carefully to avoid blocking; asbestos paper saturated with polyvinyl acetate to give strength; and a high gloss coating for magazine cover stock, for which some method must be found to prevent blocking before it becomes commercial.

One of the oldest and most sizable uses for PVAC is in chewing gum where it has moved in on im-

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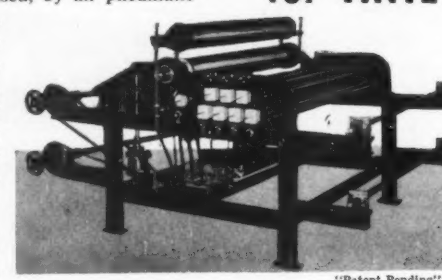

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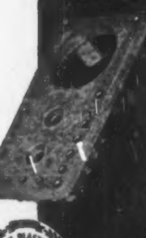

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ported chicle. One reason is price. Chicle costs nearly $1 a lb.; low molecular weight PVAC for gum is under 30 cents. A patent on this application says that PVAC is especially useful in chewing gum because it is capable of being plasticized by water and the introduction of this water is hastened by the use of soluble sugars and or conditioning agents such as propylene glycol or glycerine. The resin does not decompose and is tasteless, clean, and pure. The concentration of PVAC in chewing gum bases may range from 10 to 60% by weight, but is preferably between 25 and 35 percent.

This type of chewing gum is no relation of the famous bubble balloons that swept the country a few years ago, but they too were based on PVAC and consumed several hundred thousand lb. in two or three months' time. The fad died down so that bubble balloons now consume only a ton or two of material per year.

Starch and Concrete

A household use for polyvinyl acetate akin to textile finishing is the liquid starch sold in pint and quart bottles at 29 and 49¢ each. Several companies are reported to have used as much as 5 or 6 thousand lb. a month of PVAC for this purpose. The president of Sunlight Chemical Corp., Phillipsdale, R.I., whose company entered the business in 1949, says that one million bottles have been sold in New England and upper New York state, despite a six months' period in 1951 when no PVAC was available and even though a quart of regular starch costs only 15 to 19 cents. One television advertisement brought in 6000 requests for sample bottles. Housewives like it because one starching will last through five to eight washings. The starch is also somewhat moistureproof so that although rain drops may temporarily soften a garment, the stiffness returns when the cloth dries out. Window curtains treated with plastic starch can be wetted by rain but will dry out without losing their stiffness.

This domestic starch program is thought to be still in its infancy. There are several varieties on the market, not all of them employing PVAC; but the PVAC variety is

believed capable of holding its own in the competition.

One of the most talked about possibilities for big volume use of PVAC or a copolymer emulsion has been in concrete. Optimists have cooled down on their original estimates, since every 100 lb. of cement would require around 24 lb. of PVAC emulsion and would practically double the cost of the concrete. Nevertheless, American Polymer Corp. is selling copolymer emulsion for this purpose which they contend will improve tensile strength, abrasion, and impact resistance of the cured concrete. Another feature is that the improved properties are obtained by curing the material in dry air at ordinary room temperatures in comparison to moist curing for plain Portland cement concrete.

Even though the resin may be too costly for general use, technicians assert that it can be used for special purposes and applied thinly; possibly lower concentrations of PVAC will give satisfaction. A 2-in. top coat of resin-treated concrete would give a tough, high-impact surface.

In England, this resin-cement mixture is reported to have been used for floors around soda fountains because of its resilience, resistance to grease, and ease of cleaning. A kindred use for vinyl acetate is as a binder with artificial stone.

Another similar use in Germany is a combination material consisting of PVAC, sand, inert clays, and cement, which is troweled on floors to give a surface which actually competes with linoleum in low-cost housing developments.

Other Uses

A few other uses for polyvinyl acetate, exclusive of adhesive purposes, are briefly listed:

In tropical helmets, where a coat of PVAC emulsion before painting the helmet prevents paint from going too deep and helps reflect sun rays.

Either PVAC or butyral to modify phenolic resins used in adhering honeycomb to aluminum skin for panels in Arctic huts.

In potting compounds for transformers and in wire saturants.

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(*Continued on p. 198*)

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As the reader will note, most of the mentioned uses are for polyvinyl acetate. But the monomer itself also has some interesting possibilities as a copolymer. One most often mentioned is with maleic acid compounds for principal use as soil conditioners.

Soil Conditioners

The owner of the patent, Monsanto, now has three different types of soil conditioners. One is hydrolized polyacrylonitrile, the second is the copolymer, and the third is defined as "chemically related to the copolymer." This third one may eventually reach more volume than the others since it is designed for annual treatment of row crops.

The future volume for soil conditioners is a highly speculative enigma. From all present indications, they will remain too costly for broadscale agricultural use They are presently aimed at lawns, gardens, golf courses, greenhouses, truck farms, and roadway embankments where erosion constitutes a serious problem.

A research analyst, who knows his marketing problems, once said that the soil-conditioner field was limited to about 550 million acres which, at an average of 25 lb. of soil conditioner per acre, would account for about 14 million pounds. However, this estimate was made before the development of a row-crop soil conditioner. Many persons think that soil conditioner volume will go as high as 50 million lb.

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within the next seven or eight years. The amount of vinyl acetate used in the copolymer with maleic acid is reported to be around 45% by volume, and Monsanto has often hinted that this type should become the most widely used. However, there is no guarantee that some other resin may not eventually steal a good portion of the soil conditioner market; but as of now, vinyl acetate is an important factor in production plans which have been made for the future.

Possibilities

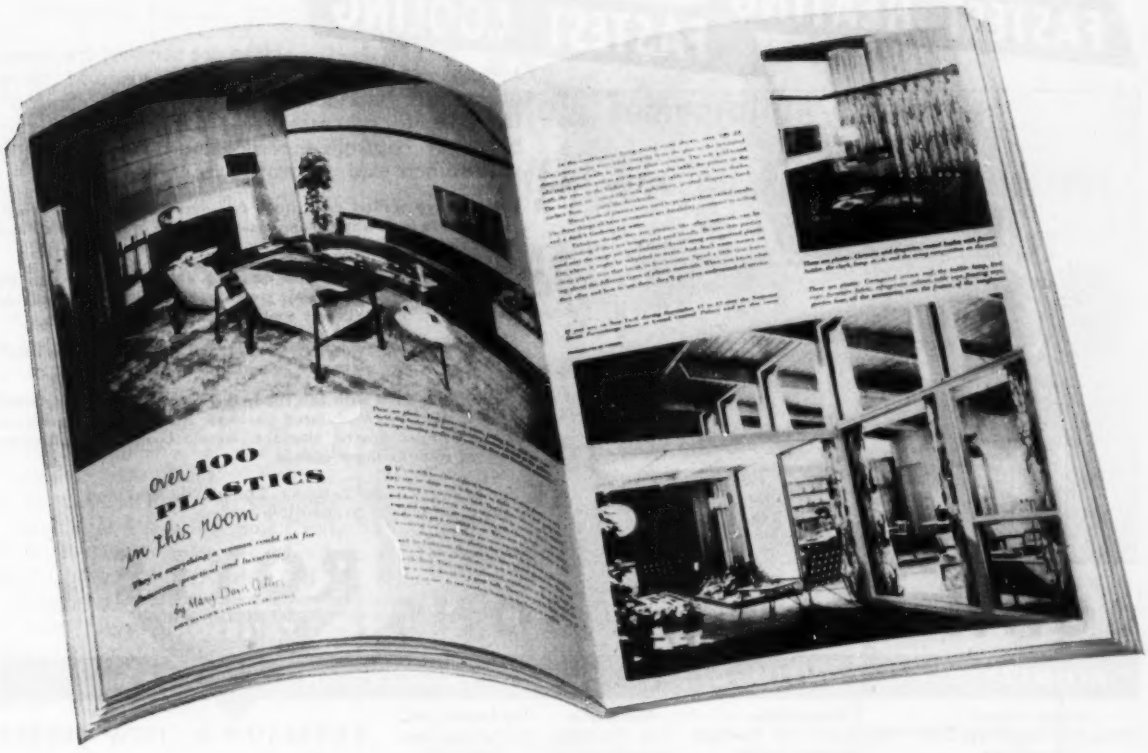
In reporting on copolymers, it must be remembered that vinyl acetate is widely used as a copolymer with vinyl chloride where it competes with polyvinyl chloride polymer and other vinyl copolymers. The amount of vinyl acetate used varies from 5% to as much as 15% by weight. Those compounds employing the most vinyl acetate are the type generally used for liquid coatings, latices, and the like.

The oldest as well as one of the largest volume compounds of this type is that used for beer can linings. Paper milk bottles are another large user of this type of vinyl acetate copolymer.

Many persons believe that there will be considerable increase in the use of vinyl acetate as a copolymer. The Bakelite patent expired a year or so ago and many companies are now experimenting with similar acetate-chloride copolymers, but there has been no announcement of commercial availability from other sources.

For years the use of vinyl acetate in a vinyl chloride-acetate copolymer for calendering, molding, and extrusion resin has been recommended because it was claimed to give better internal flexibility, a lower and sharper softening range, better adhesion, and a wider range of compatibility.

But it is now quite generally admitted that straight vinyl chloride has been improved to such a degree that these advantages are not particularly significant. There is then a considerable doubt existing as to whether there will be any great rush to set up expensive vinyl chloride-acetate production plants in view of the present available volume of vinyl chloride and copolymer facilities.—END



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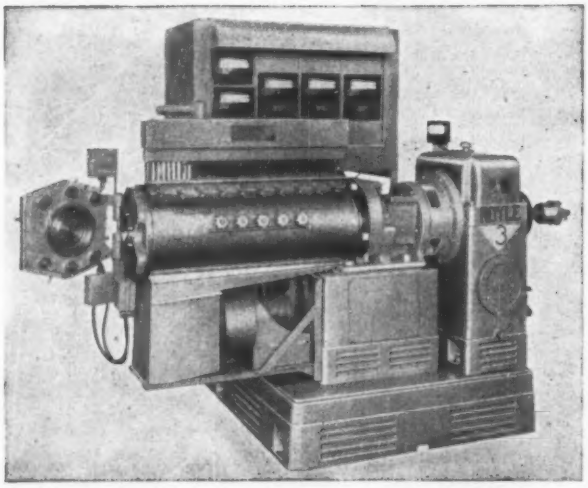

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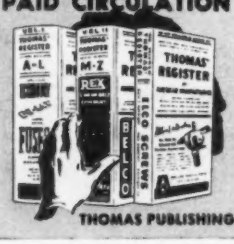

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—END

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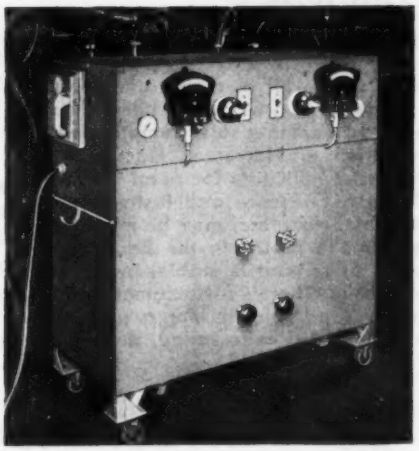
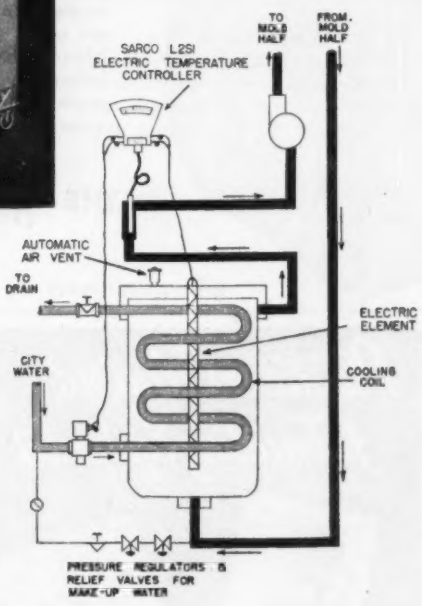
Mold Temperature Controller offers you many Exclusive Features



Sketch below shows one of the two water systems through which the Sarcotrol *Unit provides independent temperature control for each mold half.*



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- Permits faster molding cycles
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THE *Sarcotrol* Mold Heating and Cooling Unit is designed specifically for the plastics industry—to meet all injection molding requirements to best advantage. It provides separately adjustable automatic control of each mold half, by means of two independent water circulating systems. Correct temperature is maintained within 1°F on either heating or cooling cycles.

Sarcotrol Units have also been successfully applied to control water temperatures of calender rolls for extruded sheets.

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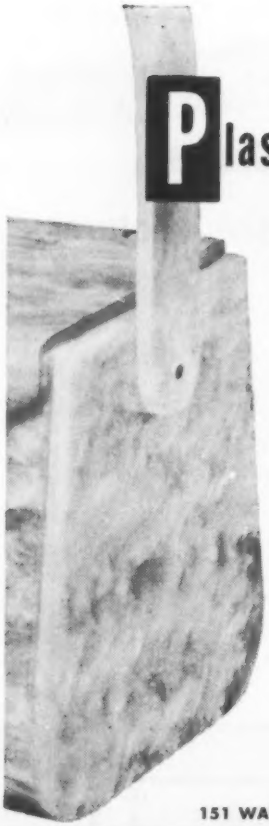

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Biaxial Stretching

(*Continued from pp.* 128-134)

inhomogeneities in the failure of metals has been reported by Epremian and Mehl (9). They found that inclusions play, by far, the dominant role in the fatigue behavior of metals.

Biaxial stretching probably would alleviate the effects of some types of submicroscopic flaws in cast acrylic sheet, since the material is heated to the rubbery state and then stretched.

The orientation of the biaxially stretched material is apparent not only from the previously mentioned X-ray diffraction measurements but also from the laminar structure of the fracture surface of a stretched specimen, as compared with the amorphous appearance of an unstretched specimen (4). This change from an amorphous to a laminar structure could account for the increase in tensile strength noted for the material stretched 140% and more. When the degree of orientation is high enough, the material might act as an assembly of independent laminae parallel to the plane of the sheet, and the force required to rupture a series of such layers would be greater than that required to rupture a single layer of material of the same total thickness. The latter would be typical of the structure of unstretched material.

The increased resistance to crazing offered by biaxially stretched material in stress-solvent crazing tests can probably be explained by similar reasoning and has been discussed in the previous report (1). Essentially the solvent acts as a plasticizer and allows the chains to be separated more easily, but the postulated molecular structure of the biaxially stretched material would again render the material more craze-resistant. When the degree of stretching reaches approximately 150%, the specimens fracture before crazing, even when using solvent.

Stretched Acrylic Glazing

The decrease in abrasion resistance of the stretched material may also be due to its laminar structure. The oriented chains that are essentially parallel to the surface may offer less resistance to abrasion than the randomly oriented chains of the unstretched material.

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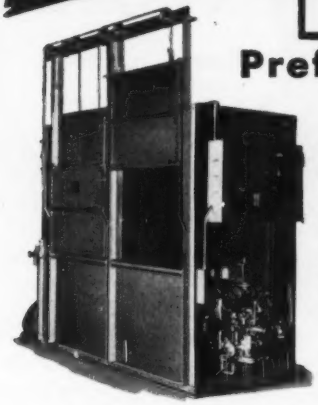

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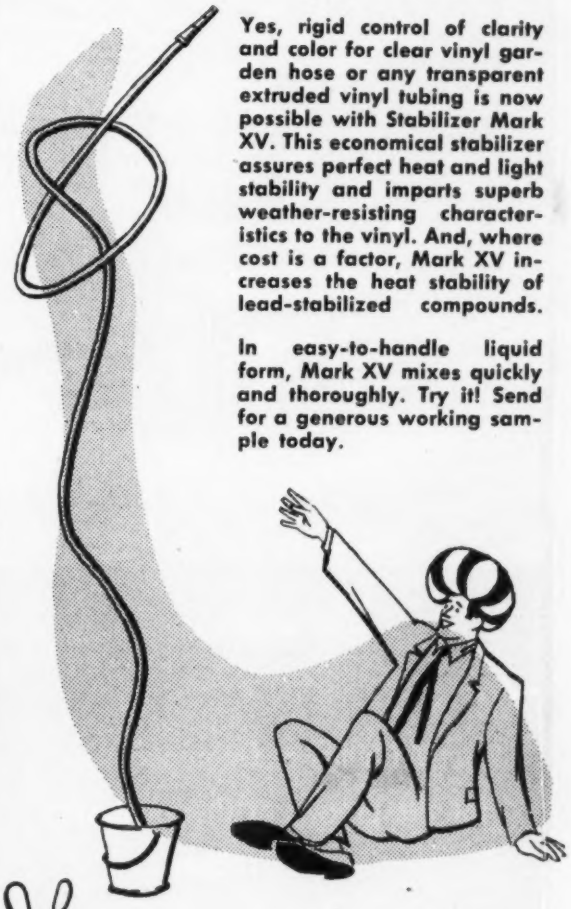

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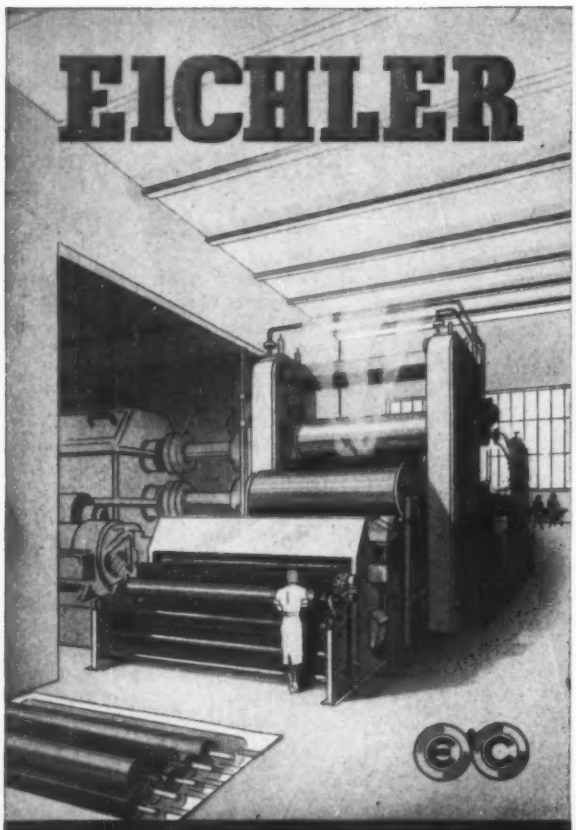

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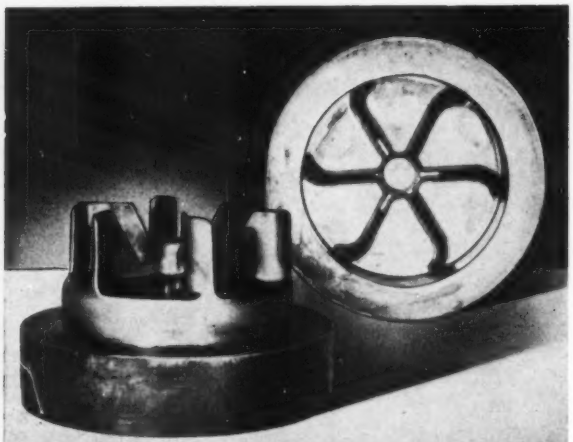

Hob diameter		8½″
Blade height		2.813″
Blade thickness	(top)	.062″
Blade thickness	(bottom)	.093″
Number of castings required		4
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acrylic plastic sheet in aircraft enclosures was suggested in a previous report (1). Since the report was issued, impact tests have been conducted by North American Aviation, Inc., on a tail gunner's enclosure (10). During the forming operation, this enclosure is essentially biaxially stretched varying amounts over its area, up to approximately 100% at the top of the enclosure. The tests indicated that the shattering characteristics in the highly stretched portions are greatly improved. Failure consists only of a hole approximately the same size as the striking cylinder. Unstretched material, on the other hand, tends to shatter under these conditions. Thus the shattering characteristics of biaxially stretched acrylic sheet suggest that the method for forming enclosures be modified to produce canopies which are stretched over the entire area, including the rim. Besides the improved impact properties, there would also be an accompanying decrease in weight and in tendency to craze.

There are technical difficulties in the forming of prestretched acrylic enclosures which would have to be overcome to make the process commercially feasible. In addition, the decrease in abrasion resistance must be considered, but this may not be serious. Enclosures have been in general use which were essentially highly stretched in certain areas during the forming operation, as in the above-mentioned tail gunner's enclosure, with apparently no serious decrease in abrasion resistance.

Acknowledgment

This work was performed as one phase of a research program whose purpose is to investigate factors affecting the crazing and strength properties of laminated acrylic glazing. The research is being done at the National Bureau of Standards under the sponsorship and with the financial assistance of the National Advisory Committee for Aeronautics. The courtesy of Mr. R. E. Leary, E. I. du Pont de Nemours & Co., Inc., and Mr. W. F. Bartoe, Rohm & Haas Co., Inc., in furnishing materials and information for use in this investigation is gratefully acknowledged, as well as the courtesy of North American Aviation, Inc., for permission to use the information cited from their

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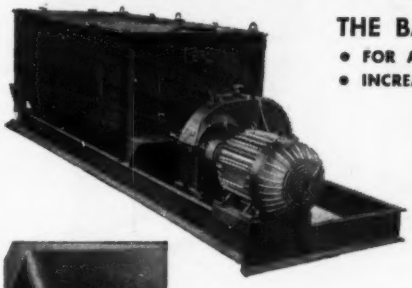

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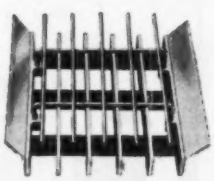

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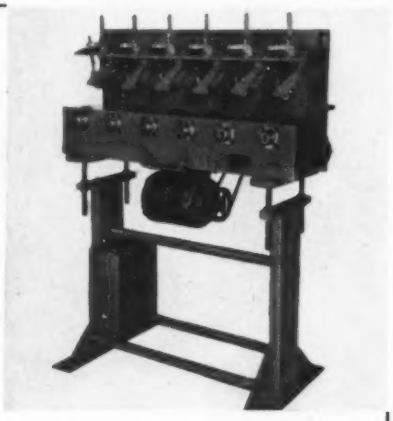

This new Progressive unit pulls rigid plastic pipe from the extrusion die at a uniform rate, giving users improved control over dimensions.

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Report No. NA-52-5. The assistance of Mr. Victor Cohen and Mr. Robert W. Mackintosh in conducting these tests is greatly appreciated. The statistical design of the experiments and analysis of the data were supervised by Mr. John Mandel. The X-ray diffraction patterns were made by Mr. H. E. Swanson.

The foregoing report is a condensation of N.A.C.A. Research Memorandum RM 53D14.

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THE PLASTISCOPE*

NEWS AND INTERPRETATIONS OF THE NEWS

By R. L. Van Boskirk

Housewares

PLASTICS have become so much a part of the housewares industry that the recent Housewares Show at Atlantic City, N.J., seemed to draw almost as many visitors from the plastics industry as would attend a regular Plastics Exposition. Those who missed the show neglected an unusual opportunity to see plastics at work in an industry where it is really "goin' to town."

The significance to molders is quite obvious. Out of a total of about 250 million lb. of styrene molding material used in 1952, close to 50 million lb. must have gone into housewares. A fair percentage of molded cellulosic materials also contributed to the housewares field. About 20 or 25 million lb. of phenolic was used for handles of electrical appliances and pots and pans. The entire thermosetting and thermoplastic molding volume in 1952 probably wasn't over 650 million lb., so it is quite obvious that molders have a big stake in this housewares field. In addition, the plastics industry was represented at the show by vinyl film and sheeting products, such as shower curtains, closet accessories, hampers, and shelf or mantel covering which were perhaps even more plentiful than kitchenware. Phenolic laminates for cutlery handles and various other applications were also standouts in numerous exhibitors' booths.

Trends were obvious to anyone who cared to look. One was the general upgrading of molded items. Of course, there were some "junk" items around but, by and large, the quality of design and substantiality of product is considerably improved.

High impact styrene — The trend toward high impact styrene for kitchenware and dishware is apparently well under way, but by no means at the level where it will be a year from now. One molder also warned that a few operators are trying to mix regular styrene with high impact material and will have only headaches for their efforts. But such things as lawn sprinklers, fly traps, dust pans, waste baskets, sink strainers, diaper hampers, and ice buckets in high impact styrene are indicative of the molders' broadening market in fields where regular styrene was likely to be too brittle. The more standard items such as canisters and various dishware items are not yet completely converted to high impact material.

Perhaps the most dazzling polystyrene items were silvered dishes or trays on display in at least three different booths; each producer claimed them as exclusive items.

Polyethylene moving in — The impact that polyethylene will have in the future housewares field was certainly apparent in any number of booths. There were a surprisingly large number of items—from sipping straws for children to 17-qt. pails that will replace galvanized metal pails for farmers—considering the fact that polyethylene molding material has been mighty scarce. One of the niftiest was a mixing bowl with a spout and specially designed handle that make it easy to manipulate. Another idea along the same line was a combination that could be used for either a mixing bowl, a pitcher, or both. Polyethylene canisters and the usual ice box containers were all over the place. A heavy walled polyethylene cutlery tray attracted an unusual amount of attention.

A cursory examination might have led a visitor to believe that there wasn't much difference in the range of items shown at Atlantic City in 1953 from that displayed in 1952 or 1951; that is, the molded items were chiefly canisters, dishes, trays, etc. But close inspection would reveal that almost every plastics exhibitor there had at least one item or two that was quite new or at least a variation or improved model of previous products. Sometimes it isn't necessary to change. For example, the molds for the original party dish (lattice work dish for bread, potato chips, etc.) and the polystyrene cutlery tray have never been taken from the press since they were started several years ago, according to their owners. Apparently the market is inexhaustible.

Vinyl on display — Vinyl products, too, were present in great quantity and certainly indicated the industry's attempts to upgrade previous years' presentations. A high-grade, transparent, 6-mil cast vinyl film for household use in covering electrical appliances and for use in refrigerator bags for vegetables was a standout. Six- to eight-gage dinette combination sets were fashionably designed for high grade customers. Scented shower curtains received a lot of attention. Products with a clear film laminated over a printed design gave evidence that this comparatively new method is taking hold. Scores of bathroom hampers with pearlized or other upholstery on the cover, and frequently even on the side walls, received unusually good customer attention.

One woodworking firm displayed a big line of vinyl upholstered mantels for imitation fireplaces; wall cabinets for knick-knacks; decorative screens; and table tops with vinyl laminated to plywood. Their entire line of wooden items is now almost completely upholstered or covered with some kind of vinyl product—generally a 12-gage sheet. Vinyl-coated paper, originally intended for pantry shelf covering but now receiving wide acceptance as wall covering, was a feature item. Garment bags and wall racks for shoes made from 12-gage sheeting had to be seen to believe that they could be so greatly improved in the past two or three years.

Handles — It is hard to guess how much plastic is going into handles for all sorts of home equipment. Almost every cutlery producer in the country is using some kind of plastic, from nitrate to impregnated wood, for handles. Both low-cost and highest quality cutlery sets now go to market with plastics handles, but the evidence was plain that impregnated wooden handles are becoming more and more standard for highest grade cutlery-ware. One

* Reg. U. S. Pat. Off.

VISIBILITY

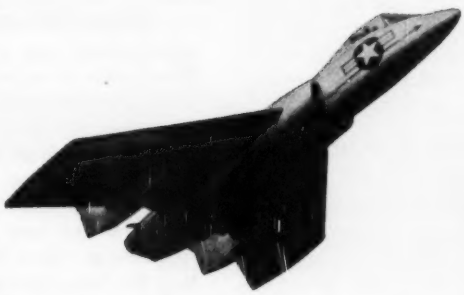
by Swedlow

in the F7U-3 Cutlass

CHANCE Vought Aircraft's twin-jet F7U-3 Cutlass, designed to out-fly or out-fight any carrier-based fighter in the world, is a larger, better-equipped, harder-hitting version of the original F7U-1 Cutlass, first sweptback-wing, tailless fighter to fly from a flat-top.

Vital factors in its maneuverability—at 650 mile-plus speeds—are the optical properties of its SWEDLOW transparent canopy and windshields.

Engineered and produced with a skill and experience outstanding in the aircraft industry, these fine Swedlow products, and four well-equipped plants behind them, are at the service of suppliers to the armed forces of the United States.



Swedlow PLASTICS CO.

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THE PLASTISCOPE

man made the unusual statement: "We use this very special styrene handle on our very best egg beater; we use wood on our lowest cost line." There were literally thousands of cooking utensils at the show and almost every one had a phenolic handle. The noticeable feature about them is that they are getting bigger and much more substantial looking. One particularly neat one we noticed was an extremely heavy pan handle with a machined-in slot near the end so that, when hung up, the pan would rest flat against the wall.

Brushes — The outstanding part that plastics fibers are playing in the brush market was obvious at the booths of nearly every one of the 25 or more brush exhibitors. Styrene bristles are apparently growing in use by leaps and bounds, but particularly impressive was the "soft and fine" feel of saran bristles used for such things as back brushes and other toilet brushes. Brush producers said that, strangely enough, the synthetic bristle was not cutting into their fiber bristle brush sales to any great extent, but was adding tremendous volume to their general all around sales. And in connection with saran, a dry mop made from saran yarn, was noted which could not be distinguished by eye nor feel from a cotton strand mop, but would be practically immune to deterioration from dirt or grease.

Alkyd-Glass Compound

PRODUCTION of a new, improved fibrous glass reinforced molding compound, called Glaskyd, is now under way in the plant of Perrysburg Laboratories, Inc., Perrysburg, Ohio. The compound, containing chopped fibrous glass strands and special formulations of alkyd resins, is extruded in rope-like form. Special equipment for cutting and feeding the compound to molds permits higher speed and more completely automatic molding cycles than heretofore possible with glass reinforced materials.

Ralph Perkins, Jr., formerly manager of the Plastics Reinforcement Div., Owens-Corning Fiberglas Corp. for five years, and nine years with the Plaskon Div., Libbey-Owens-Ford Glass Co., is president of Perrysburg Laboratories. Dr. Arthur M. Howald, who developed Glaskyd, is vice president and general manager. He was for many years technical director of L-O-F's Plaskon Div. Saunders P. Jones, formerly president of Jones-Dabney Paint Co., Louisville, Ky., is chairman of the board.

High Impact Phenolics

NEW entrant into the field of high impact phenolic molding compounds is Synvar Corp., Wilmington 99, Del. The following compounds are being manufactured in natural and black: Synvar PM-88502, natural, and Synvar PM-88512, black, and an impact of 0.6 to 1.0 ft. lb./in. of notch; Synvar PM-88500, natural, and Synvar PM-88510, black, with an impact of 1.0 to 2.0 ft. lb./in. of notch; Synvar PM-88501, natural, and Synvar PM-88511, black, with an impact of 2.0 to 3.0 ft. lb./in. of notch.

These new compounds will supplement Synvar's present line of general purpose, heat-resistant and improved impact phenolic molding compounds.

Teflon Silicone Gaskets

MATERIAL for gaskets, equally effective at the high temperature of hot-air ovens for chemicals or the low temperatures of arctic regions or high-altitude flying, has been developed by Joclin Mfg. Co., 2964 Whitney Ave., Hamden, Conn. Sales agent for the new gaskets is The Connecticut Hard Rubber Co., 407 East St., New Haven 9, Conn.

Called Fluorlastic gaskets, they combine the chemical resistance of Du Pont Teflon resin with the resilience and flexibility of silicone rubber. Their properties are unaffected by temperatures ranging from —130 to 392° F.

The gaskets consist of long strips of foamed silicone rubber wrapped in sheets of Teflon. These are formed to permit edges of the sheeted Teflon to extend laterally beyond one side of the silicone core. The edges are then heat sealed to form an impenetrable envelope around the resilient core material.

It is expected that this gasketing material will find many applications by oven and autoclave manufacturers.

Vinyl Core for Wire Rope

ANOTHER wire rope with a plastic core is now available from Irvington Varnish and Insulator Co.'s Fibron Div., Irvington 11, N. J. The core, made of specially formulated plasticized vinyl chloride material, finds its principal application in wire rope used for oil and gas well drilling. The company reports that four years of service tests have given conclusive proof of field economies.

Irvington has also added a new heat-resistant insulating varnish, called Irvington #180 to its line of insulating materials. The new varnish can be used at temperatures as high as 356° F. It has a clear color, excellent oil and moisture resistance, and a dry dielectric strength of 2100 v. per mil.

Adhesive Cures Without Heat

DEVELOPMENT of an emulsion-type adhesive which can be used for joining material that ordinarily must be bonded with heat-curing adhesives has been announced by American Resinous Chemicals Corp., Peabody, Mass. Called ARCCO 1294-31L, the adhesive is ideal for users who do not have heat-curing facilities available. Mild heat may be used to promote bond formation if more drying speed is desired.

ARCCO 1294-31L is being used for such bonding applications as adhering abrasive papers and fabrics to buffing wheels, leather to Neolite belting, leather to leather, leather to fabrics, plastics film to paper and wood, and various other applications where strong heat-resistant bonds are necessary.

Licenses for Foundry Casting

PATENTED methods for using urea resins in the casting of light metals are being offered in royalty-free licenses by Plaskon Div., Libbey-Owens-Ford Glass Co., 2112 Sylvan St., Toledo, Ohio. The L-O-F patent, No. 2,422,118, was obtained in 1947.

The patent announcement was

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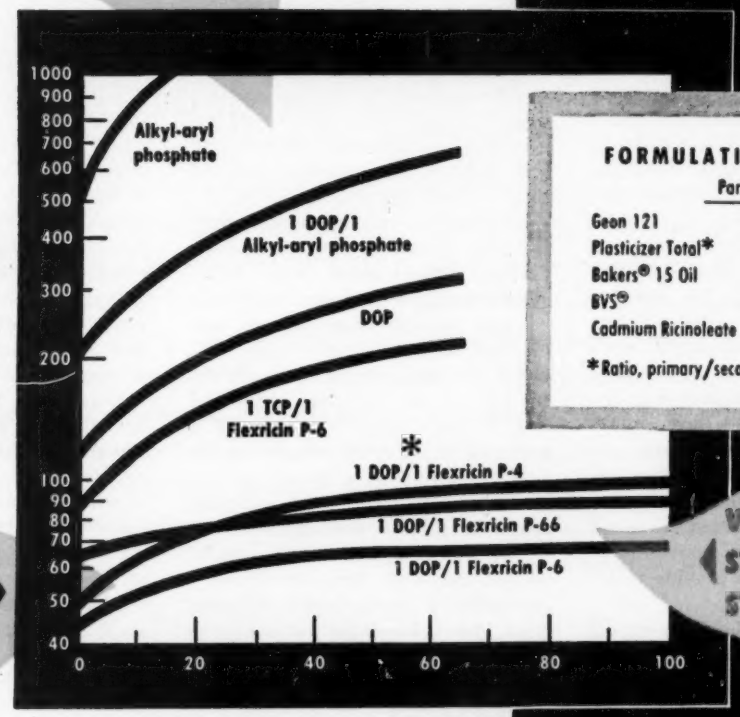

FORMULATION

	Parts (wt.)
Geon 121	100
Plasticizer Total*	63
Bakers® 15 Oil	1
BVS®	1.6
Cadmium Ricinoleate	.8

*Ratio, primary/secondary

TIME—DAYS: 25°C at 48% R.H.

YOUR CHOICE:

Flexricin P-4 Methyl Acetyl Ricinoleate
Flexricin P-6 Butyl Acetyl Ricinoleate
Flexricin P-66 Isobutyl Acetyl Ricinoleate

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made simultaneously with Plaskon's statement that three new core binder resins are available through Frederic B. Stevens, Inc., Detroit, Mich., exclusive distributor of Plaskon foundry resins. The three resins—powdered urea, liquid urea, and powdered phenolic—are used in binders for making sand cores with closer tolerances.

Insulating Materials

THREE new insulating materials—G-E 9615, G-E 76510, and SR-17—have been developed by General Electric Co., Pittsfield, Mass.

G-E 9615 is a clear baking organic varnish offering high bonding strength combined with flexibility and long life at Class B temperatures and above. It is claimed that this material provides a bonding strength equal to or better than any other organic heat resistant impregnating varnish known. The material bonds as well as any other ordinary phenolic varnish to electrical components, to Mylar, and to silicone-glass insulations. G-E 9615 was developed for generators and motors with insulation temperature requirements greater than Class A, and it is also suggested as a binder for cotton or glass served wire and as a finish coat over conventional Class H insulation to provide moisture protection.

G-E 76510, which is really an old product dressed in a new coat, is a silicone rubber-coated glass cloth tape and wrapper. The new silicone rubber coat has replaced the ordinary silicone material formerly used on standard Class H insulation. It is particularly useful because it overcomes cracking problems inherent in brittle resin products. General Electric claims that glass cloth tapes and wrappers covered with this material are the toughest ever produced and have a tensile strength of 130 lb. per in. of width.

SR-17 is a silicone resin that can be used for a variety of insulating applications which ordinarily require several different materials. The new silicone varnish possesses a combination of heat resistance, low-temperature flexibility, and high bonding strength. Multiple uses for the product include coating glass cloth for Class H insulation, providing a bond for mica tapes and coil wrappers, treating glass sleeving, and impregnating asbestos for layer insulation. SR-17 can also be used as a resin base for protective and decorative paints requiring heat and weathering resistance. The company states that with SR-17, requirements for both high-temperature insulation and low-temperature flexibility can be met by altering the cure rather than by changing resins.

General Electric also announces the development of an improved line of Class H fibrous glass tubing and sheeting, and a new grade of sheet mica insulation.

The tubing and sleeving, called BH-1151, is produced from braided fibrous glass coated with heat-resistant silicone rubber. Its electrical and physical properties are unaffected by continuous operation through a temperature range of —90 to 400° F.; it will also withstand 600° F. for at least 15 minutes. The material is presently being used for lead insulation on a variety of remote control circuits hermetically sealed in gaseous atmospheres.

The sheet mica insulation can be stored twice as long as ordinary bonded mica products and still combine the advantages of extreme flexibility and low-binder content. The new sheet mica product results from the use of a new resin recently developed as a bonding agent for metal, but never before used as a mica binder. This resin will not ooze when heated under pressure, yet imparts such outstanding flexibility that sheets up to 10 mils thick can be bent around a ½-in. mandrel without chipping.

Vacuum Coating Tank Liner

NOW available from National Research Corp., 70 Memorial Dr., Cambridge, Mass., is a plastics coating which is applied to the inside of vacuum coating tanks to prevent adhesion of successive layers of evaporated metal.

The product is called Narliner. It dries rapidly after spraying and can easily be stripped from the walls, leaving them clean and ready for another application of the liner.

Glass Cloth

PRODUCTION of glass cloth has been announced by another company, Cheney Bros., Manchester, Conn., one of America's oldest silk and nylon weavers. The company works closely with Pierre Genin Co. of France, old-time glass weavers.

The material, called Textiglass, will be distributed exclusively by Textiglass Div. of Madagascar Graphite & Mica Co., 92 Liberty St., New York 6, N. Y., with E. J. Van Dyck as sales manager.

Enamel for Polystyrene

A FAST-drying enamel especially formulated for coating or decorating polystyrene has been added to the line of surface coatings produced by Schwartz Chemical Co., Inc., 326 W. 70th St., New York 23, N.Y. Designated as Rez-N-Lac, the enamel is available in a wide choice of bright colors, including clear and white. The company also offers to meet the exact color requirements of polystyrene fabricators.

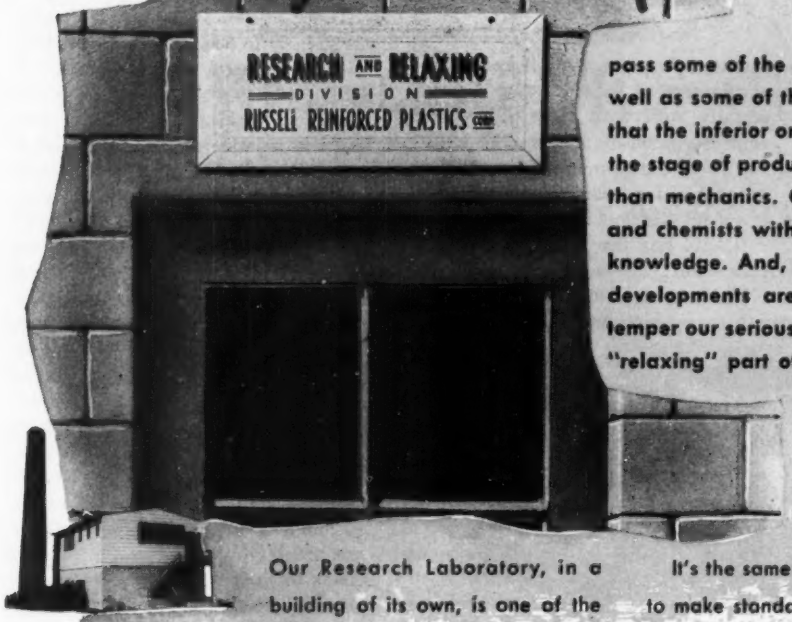
Rez-N-Lac, which can be applied by spray or brush, is reported to contain a substance that alters the polarity of the polystyrene surface so that complete and permanent adhesion results. The mold solvents used prevent crazing or softening of even the thinnest polystyrene sections, according to Schwartz.

School for Plastics

ESTABLISHMENT of a specialized course on plastics at the Machine and Metal Trades Vocational High School in New York City has been announced as part of a program carried on by the New York section, Society of Plastics Engineers, Inc. The course, open to selected senior year students, will cover the manufacture of plastics, including raw materials and injection, extrusion, and other methods of molding and fabrication.

The Society of Plastics Engineers cooperated with the New York City Board of Education to organize the course and prepare the curriculum. This work was conducted by the Plastics Education Commission of the Advisory Board for Vocational

Through this portal



pass some of the most beautiful ideas in plastics . . . as well as some of the most impractical ones. But it is here that the inferior ones are rejected long before they reach the stage of production for at Russell, we are much more than mechanics. Our key men are graduate engineers and chemists with a wealth of practical and theoretical knowledge. And, because we believe that outstanding developments are rarely achieved under pressure, we temper our serious analyses with a dash of humor as the "relaxing" part of our sign will attest.

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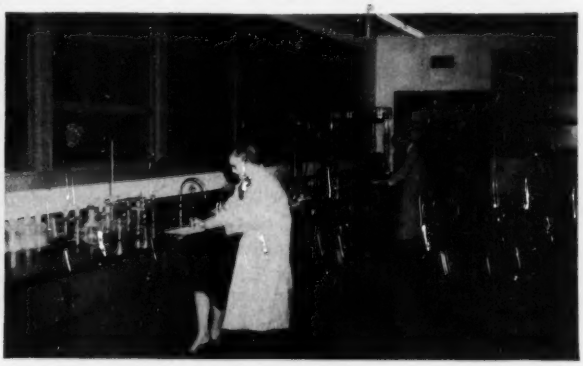
Ours is a combination that is hard to beat. So, when you have a problem in reinforced plastics . . . in matched die molded parts, flat panels or sandwich construction, we suggest you consult RUSSELL *first*.



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and Extension Education. Harold Schwartz, chief of the Plastics Div., Empire Brushes, Inc., and vice president of the New York Section of S.P.E., is chairman of the Commission and is assisted by Richard M. Thews of Monsanto Chemical Co.

Polyethylene Bottles

INTRODUCTION of a new line of polyethylene bottles under the Braun trademark has been announced by W. Braun Co., 300 N. Canal St., Chicago, Ill.

The company has formed a subsidiary, Plasticrafters, Inc., to supervise manufacturing and marketing details of the new line. Several sizes of standard styles are already available as stock items. Special attention will be given to private mold designing, as well as to applied labeling and decoration, through another Braun affiliate, Glasscrafters, Inc.

Vinyl Chloride Plant

IN ANNOUNCING that his company's net sales for the six months ended June 30, 1953 were $43,400,000 as compared to $38,700,000 for the same period in 1952, Raymond F Evans, president of Diamond Alkali Co., reported that prospects for the balance of 1953 appeared very favorable.

Mr. Evans also stated that the new polyvinyl chloride resin plant at Houston, Texas, is now in trial production and that some sales volume could be expected from this source during the remainder of this year.

Polyester Time Saver

AVAILABILITY of a new fast-curing polyester resin, IC-514, to fabricators of reinforced plastics is announced by Interchemical Corp., 67 W. 44th St., New York 36, N.Y. Tested under S.P.I. standard procedures, the new resin takes a full 1½ min. off the gel time and 1 min. and 50 sec. off the cure time of conventional polyesters, thus effecting a 32% saving in production time with no loss in physical properties and actually improved pot life.

The resin has been especially formulated for use with fibrous glass reinforcement, but it may be used equally well with other fillers and reinforcement materials. The material's fast cure makes it particularly adaptable for matched metal mold press applications.

IC-514 has the following physical properties:

Viscosity	600-700 cps at 70° F.
Monomer styrene	Nominally 35%
Specific gravity	1.12
Heat distortion temperatures	95° C. at 264 p.s.i., 116° C. at 66 p.s.i.
Barcol hardness	50-55

Peelable Plastics

WITHIN the last few months, the United States Armed Services have purchased over 2 million lb. of cellulose acetate butyrate peelable plastics for use in coating metal parts to prevent corrosion during shipment or in storage. Supposedly, this is a year's supply insofar as the butyrate part of the order is concerned.

The purchase helps call attention to an application that received considerable attention during World War II, but so far has failed to make as big a dent in the civilian economy as was expected. Even though there are now eight or ten companies engaged in the production of both butyrate and ethyl cellulose peelable plastics (strippable coatings), the estimated production for civilian use is less than 1 million lb. a year. However, there seems to have been a revived interest in the material of late, particularly in Europe.

There are essentially two different types of coatings involved in peelable plastics—a hot melt material and a solvent material. The first is for dipping, the latter for spraying or brushing. The ethyl cellulose solvent type sells at around 80¢ per gallon. There is also a vinyl solvent coating of this type which may be sprayed or brushed on to a thickness of 3 or 4 mils and can be stripped off. Another similar material is a plastisol that is fused after dipping. These vinyl type peelable plastics should not be confused with the ethyl cellulose or butyrate hot melt types since the vinyl types are much higher priced and used for different purposes.

The ethyl cellulose hot melt material is 20 to 25% resin and the balance is mineral and castor oil. It sells for 35 to 40¢ a pound. The butyrate material is 40 to 50% solid and the balance of the compound is generally D.O.P. and Dowresin 276-V-9. It sells at over 60¢ a pound.

The Army claims that the latter is needed for their purposes because of its transparency and exceptional weathering properties in long time field storage. In civilian applications, ethyl cellulose hot melt is widely used because of the price differential. The widest use is in inter-company shipments of tools and parts, but big volume development is slow because the material can be remelted and used over and over again. Another interesting though minor use is as a coating for golf club heads to preserve them against tarnishing. Producers are expecting a gradual increase in demand for hot melt coatings as industry finds more uses but, as can be seen from the above, no one is expecting big volume development in the foreseeable future.

Gas Transmission

EVALUATION of gas transmission rates of flexible packaging materials will be studied under a research contract granted to the Research Foundation of the State University of New York by the Office of the Quartermaster General, U.S. Army. Dr. Michael Szwarc and Dr. Vivian T. Stannett will conduct the study at the State University College of Forestry, Syracuse, N.Y.

The contract with the Quartermaster calls for a basic analysis of the movement of different types of gases, under various conditions, into and through many types of polymeric and cellulosic film.

Vinyl-Coated Rayon

INTRODUCTION of a new vinyl-coated rayon, called Toloron Straw, has been announced by Textileather Corp., 607 Madison Ave., Toledo 3, Ohio. It is the first rayon-based material with a vinyl coat that has ever been produced by the company.

Toloron, manufactured in seven different colors, has the appearance

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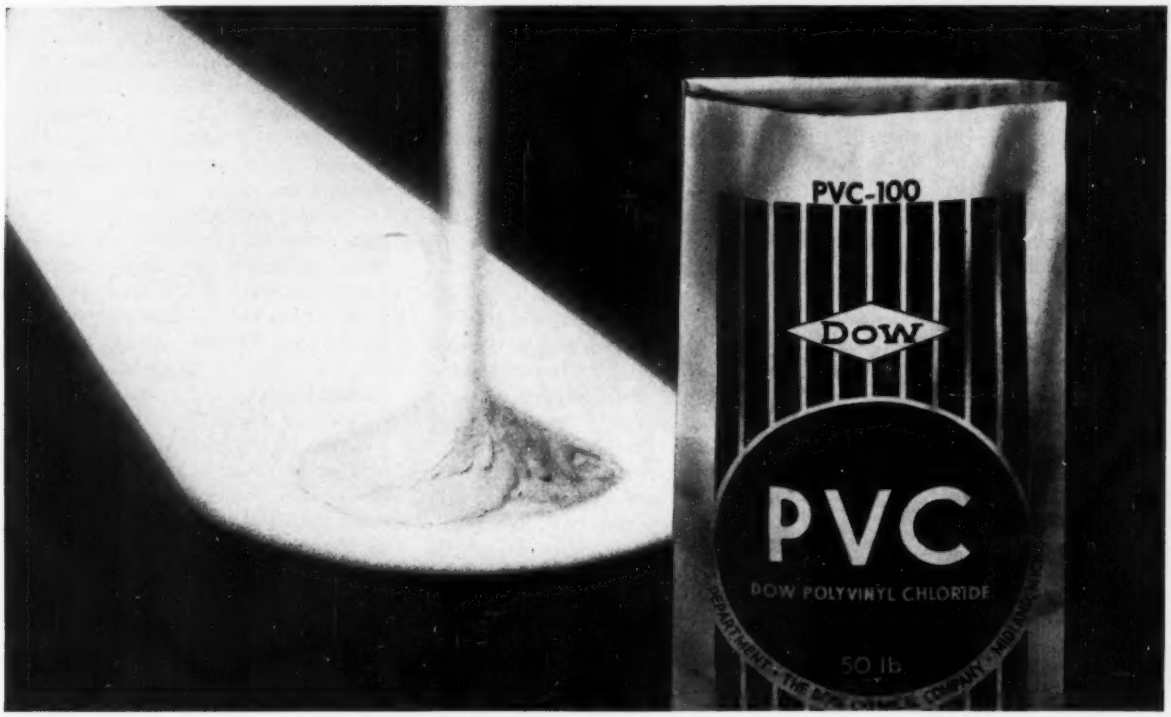

PVC-100 is the first of a series of vinyl chloride resins to be made available in production quantities to industry by Dow. As a result of Dow's past manufacturing experience with vinyl polymers, a superior processing technique coupled with a new plant installation has resulted in a product of consistently high quality and uniformity.

PVC-100 is suited to high-speed calendering operations for the manufacture of light gauge film. It can be used very satisfactorily in extrusion applications. PVC-100 also lends itself to dry-blend extrusion techniques with good results. PVC-100 finds an excellent application in the manufacture of pharmaceutical tubing with very low residual metallic content.

Dow PVC-100 standard shipping containers include 50-pound Multi-wall paper bags or standard 41-gallon saran lined fiberpaks.

Further details about PVC-100 may be obtained by writing to THE DOW CHEMICAL COMPANY, Plastics Department PL 1482, Midland, Michigan.

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of woven straw and is available in 26-oz. weight and 54-in. width. The material has a high tear strength and is easy to work, particularly in upholstering corners.

Textileather is also producing a new creation, called Fern, which is a deeply embossed pattern with a silken look and is especially designed for home or club furnishings.

Plywood Glue

ACCORDING to Bureau of the Census figures, the amount of glue used by the softwood plywood industry in 1952 was 97,500,000 lb., in comparison to 103,500,000 lb. in 1951. However, caution should be used in comparing these figures because they have been reported on a dry resin basis only since April 1951.

The 1952 figures are broken down according to materials as follows: Phenolic resin, 27,600,000 lb.; urea, 3,700,000 lb.; soy bean, 56,000,000 lb.; casein, 2,500,000 lb.; Other, 7,800,000 pounds.

The figures for May, the last month reported in 1953, were 2,700,000 lb. of phenolic resin in contrast with 1,700,000 lb. in 1952, and 2,600,000 lb. in 1951.

Pelletizing Plant

NEW pelletizing facilities for the processing of plastics have been put into operation by Alpha Chemical & Plastics Corp., 11 Jabez St., Newark 5, N.J. Present facilities permit coloring, screening, and pelletizing of polyethylene. Activities are soon expected to extend to styrene molding and extrusion compounds.

The milling, mixing, and grinding equipment at the plant is presently being used exclusively for the processing of vinyl scrap and virgin material.

J. Hirschberger and Eric F. Ross, officers of Alpha, also head Rotex Rubber Co., Newark.

Color Changes for Urea

A PROPOSAL by material manufacturers to make some changes in the colors covered by Commercial Standard CS147-47 has been approved by the Standing Committee for Colors for Molded Urea Plastics, according to an announcement by the Commodity Standards Div., U. S. Dept. of Commerce, Washington 25, D.C. The changes are as follows:

a) The colors designated as MUP-60 (black) and MUP-58 (orange), will be discontinued because they have very little use in the industry.

b) Four new colors—medium grey, Kelly green, tan, and navy blue—will be added to the list of standard colors.

c) There will be a slight change in white, designated as MUP-02, to improve that color. This is made possible by the use of pigments that were formerly unavailable or were in very short supply.

Commercial Standard CS147-47 was adopted by the industry in 1947. It includes 17 colors and is universally used throughout the urea plastics industry. The changes will result in a net increase in the number of colors from 17 to 19.

Those who wish to inspect moldings of the new colors should address their request to F. W. Reynolds of the Commodity Standards Division. Any interested member of the industry who has an objection to any of the changes should submit it before Sept. 1, 1953. If any objections are received, they will be referred to the Standing Committee of the industry for consideration.

Laminated Fibrous Glass

LAMINATING equipment to produce a general line of aluminum, paper, plastics, synthetic rubber, and cloth facings for superfine fibrous glass for insulation has been put into operation at the Fiber Glass Div., Libbey-Owens-Ford Glass Co., Parkersburg, W. Va. J. M. Johns, general manager, claims that laminated facings increase the general usefulness of the blanket-type fibrous glass insulation. The first shipment of newly-faced fibrous glass was an aluminum foil lamination for use in lining the metal jacket of warm air furnaces.

Lamination of film facings include clear, black, and aluminum-pigmented vinyl and saran. The vinyl- and saran-faced fibrous glass laminates may be used in aircraft, submarine hulls, and in small refrigeration and air conditioning equipment.

Maximum width of the aluminum and vinyl-faced fibrous glass is 54 inches. The three colors of saran facings are applied in maximum widths of 48 inches.

Trademark Change-Over

CHANGING a trademark that has a reputation which has been meticulously built up over a long period of time is an unusual procedure. Yet Bakelite Co., a Div. of Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N.Y., has made that drastic move in changing the "Vinylite" trademark for its calendered plasticized vinyl film and sheeting to "Krene."

The best guess for the reason is that numerous firms, which have been producing film and sheeting from Bakelite's Vinylite resin or competitive vinyl chloride resins, have been "borrowing" the name Vinylite, or one almost indistinguishable from it, for use on their finished products. These items then compete in the market with products made from Bakelite's finished film or sheeting. In order to end this confusion, Bakelite has apparently taken steps to draw a sharp distinction between the name of their film based on vinyl resin and all other film and sheeting made from vinyl resin. The trademark "Krene" has been Union Carbide property since World War II days, at which time it was used in conjunction with vinyl products offered for sale by National Carbon Co., also a Div. of Union Carbide. When that organization ceased fabrication of vinyl film into end products, the trademark "Krene" remained in Union Carbide's possession and is now put back to work after a short vacation.

Bakelite started producing calendered vinyl film and sheet several years before World War II to prove the practicality of its new vinyl resin product. At that time, it was deemed necessary to set up its own calendering facilities for the manufacture of film and sheeting in order to establish and maintain standards for a new product that required new and highly technical operational methods. Ever since that

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time, Bakelite has been the largest volume producer of film and sheet. Even today, when there are 30 or more calenderers in the field, Bakelite produces a larger volume than any other processor.

A nationwide advertising campaign in leading consumer magazines to inform the public about the change from Vinylite to Krene will be inaugurated at once.

The items to be featured include rainwear, luggage, closet accessories, shower curtains, and inflatables. To aid in the coordinated merchandising program, Bakelite has engaged Pokrass & Gauss, Inc., retail sales promotion counselors, who will assist merchandisers in making the program effective by showing them how they can tie in with the national Krene promotion enterprise.

A program to assist the fabricators has also been devised, whereby he can identify products made of Krene by the use of tags and labels displaying the trademark.

More Polyethylene?

THE first step in the completion of National Petro-Chemicals Corp.'s $44 million project at Tuscola, Ill., was taken last month when the hydrocarbon extraction and fractionation units of the plant began processing natural gas. Dr. R. E. Hulse, vice president of the company, stated that polyethylene production will begin on this site early in 1955.

When operating at capacity, the hydrocarbon plant will have a daily output of 450,000 gal. of natural gas liquids—propane, butane, isobutane, and natural gasoline. In addition, 10 million cu. ft. of ethane per day will be recovered from the natural gas for conversion into ethylene. The initial chemical production from ethylene will consist of 40 million gal. of synthetic ethyl alcohol per year and 50 million lb. of ethyl chloride per year.

National Petro-Chemicals Corp. is a joint venture of National Distillers Products Corp. (60%) in partnership with Panhandle Eastern Pipe Line Co. (40%). The plant is built on 442 acres of land, west of Tuscola, at the junction of two major gas transmission systems which carry gas from the Gulf Coast, western Kansas, and Oklahoma.

Silk Screening for Acetate

DEVELOPMENT of a new silk screening finish for cellulose acetate plastics has been announced by Logo, Inc., 13799 S. Avenue O, Chicago 33, Ill., a subsidiary of Bee Chemical Co.

The material, called Logoquant Series AV-46, is extremely resistant to plasticizer migration and is flexible beyond requirements of any standard test. Company officials claim that it was particularly developed to solve the critical adhesion problems that have been existent in printing on many acetate items.

Fumaric Acid

COMMERCIAL quantities of fumaric acid are now available from Monsanto Chemical Co., St. Louis 4, Mo. The product is used in much the same manner as maleic anhydride in the production of resins for surface coatings, inks, polyester resins, and as a modifier of phthalic-type alkyds.

Purging Compound

AVAILABILITY of a 25¢ per lb. purging compound for injection molding machines is announced by A. Bamberger Corp., 703 Bedford Ave., Brooklyn 6, N.Y. The compound is used by molders to speed up color changes.

Working samples will be sent gratis to injection molders upon request to Bamberger.

Ultra-High-Frequency Insulation

DEVELOPMENT of a lower cost ultra-high-frequency insulating material with good heat resistance and excellent machinability has been announced by The Polymer Corp. of Pennsylvania, Reading, Pa. The material is known as Polypenco Q-200.5. The producer states that it can be used for electrical, electronic, communication, and allied equipment where a stiffer material than Teflon is required.

Applications so far have been for coaxial spacers, uhf. antenna insulators, stand-off insulators, coil forms, and connector beads. The rigidity of the material makes it suitable for applications where other insulators have failed or were not satisfactory because of cold flow characteristics.

Insulators made from this material are claimed to withstand temperatures up to 400° F. under light load conditions. The heat distortion temperature is 220 to 225° F. at a 264-p.s.i. fiber stress.

The relatively infusible nature of the material keeps it from softening or gumming up from heat generated during machining. The same tools as those used in cutting brass are recommended.

Polypenco Q-200.5 is available in rods of ⅛- to 1 in.-diameter and in lengths of 6 to 8 feet. Other shapes and sizes can be supplied on special order.

Metallic Color for Sheet

ADDITION of cellulose acetate butyrate to the line of metallized materials available for vacuum forming has been announced by Coating Products, 136 W. 21st St., New York 11, N.Y.

Designated as Mirro-Brite V153, the butyrate supplements metallized cellulose acetate and polystyrene for deep drawing purposes. It is available in 0.010, 0.015, and 0.020 gage and in continuous rolls 21 in. wide or cut-to-size sheets.

Machine for Applying Color

MANUFACTURE of a new bench-type, manually operated machine for applying color to machinery, instrument, clock, and television dials is announced by The Acromark Co., 559 Morrell St., Elizabeth 4, N.J. Foot and motor-driven models are also available.

The company claims that 20 to 50 dials can be filled in a minute and that the machines can be adapted to special as well as standard dials.

EXPANSION

Regal Plastic Co. has leased 30,000 sq. ft. of space in the A. J. Stephens Bldg. and has moved its entire operations to the new location at 14th & Chestnut St., Kansas City, Mo. The company is one of the plastics organizations that had its start in a basement in the home of **Jerome S. Kivett**, president of the company,

BARBER COLMAN

Wheelco Instruments

. . . standard control equipment on REED-PRENTICE injection molding machines

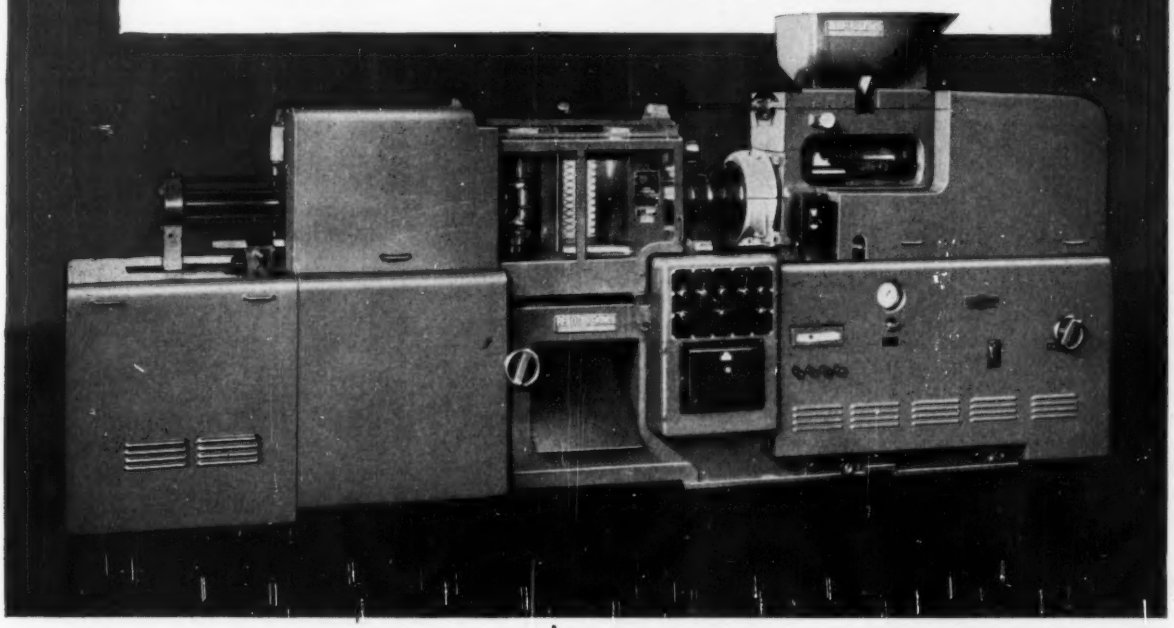
You can count on dependable, accurate results from injection molding operations performed on the Model 10D-12 oz. "Reed." One reason is that molding temperatures are under ever-vigilant control of Wheelco Capacitrols—automatic pyrometer controllers for indicating and controlling all temperature ranges in plastic within closest limits.

Dual Wheelco Panelmount Capacitrols give independent temperature control for front and rear heating cylinders. With built-in Capaciline, they provide low-cost proportioning control. Instantly fast in controlling the electric heating load, they eliminate heat transfer lags. Hence, there is no underswing or overshooting of control temperature.

Your Wheelco field engineer will be glad to demonstrate control improvements you may expect by replacing slow-responding temperature instruments with Wheelco Capacitrols!

Model 10D-12 oz. Injection Molding Machine, manufactured by Reed-Prentice Corp., Worcester, Mass., plasticizes up to 80 lbs. of material per hour. Heater design and construction plus Wheelco proportioning-type Capacitrols provide uniform rapid plasticizing of all thermoplastic materials.

Electronic Control Principle of Wheelco Capacitrols provides automatic no-contact system, fast, accurate results. Simple design eliminates maintenance, keeps instruments in continuous proper adjustment.



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and has now grown into a firm employing 100 persons and will double that personnel in the new premises.

Products manufactured by the company are plastics furniture, industrial parts, carrying cases, refrigerator door sections, and airplane parts. Among the firm's customers are Dictaphone Corp., Revere Camera Co., Bell & Howell Camera Co., Bendix, Westinghouse, Chrysler Corp., Servel, and Trans-World Airlines.

The Jason Corp., Hoboken, N. J., known as manufacturer of Sealtuft stitchless quilted plastics, is enlarging its facilities to provide equipment for multi-color printing, embossing, laminating, valley printing, high-gloss polishing, and other surface effects.

The converting operations will be under the general supervision of **Benjamin Messing**, president of the company; sales to fabricators will be directed by **Donald Dugan,** formerly general merchandising manager of Gimbel Bros., New York, N. Y.; and **Emanuel Raices,** general sales manager, will be in direct charge of the automotive, juvenile, and novelty fields.

Watertown Mfg. Co., 1000 Echo Lake Rd., Watertown, Conn., has increased its production facilities for the manufacture of Watertown Lifetime Ware for the sixth time in three years. The company, pioneer manufacturer of Melmac dinnerware, also announces the introduction of Woodbine, a new embossed leaf design, made of Melmac. The new addition consists of four 350-ton presses, housed in a new wing.

American Machine & Foundry Co., 511 Fifth Ave., New York 17, N. Y., will establish a chemical research and development laboratory at Springdale, Conn., as an expansion of research and development activities of A.M.F.'s Chemical Research Dept. **G. P. Hungerford,** research manager, will continue to direct the activities of the laboratory, which is presently located at the company's Brooklyn, N. Y., plant. Functions of the laboratory will include the research and development of new products and processes in the fields of foods, tobacco, plastics, electrical insulation, general chemical technology, and the design of processing equipment in those fields.

The Plas-Tex Corp., 2525 Military Ave., Los Angeles 64, Calif., announces the completion of a $350,000 factory addition. New machinery and facilities designed to increase production of Plas-Tex housewares 50% are now in operation. As part of its expansion program, the company has appointed 20 new representatives to handle sales throughout various sections in the United States.

Reed Plastics Corp., 116 Gold St., Worcester 3, Mass., compounders of thermoplastics material, has added 10,000 ft. of manufacturing space to its present operation. The company claims that this addition, together with new production equipment, makes possible a 40% increase in its capacity.

Fanner Mfg. Co., Brookside Park & Blvd., Cleveland, Ohio, has entered the plastics industry with the purchase of **Munray Products, Inc.,** producers of plastics pipe, plastics tank linings, plastics coatings, etc. **C. Grief Raible** is president of Fanner; **William Munkacsy**, founder of Munray Products, remains as president and general manager of that company and will be in charge of Fanner's plastics activities. Munray Products will continue to operate at 12400 Crossburn Ave., Cleveland 11, Ohio.

Reichhold Chemicals, Inc. will construct a new synthetic resins plant in the Fairfax industrial district of Kansas City, Mo. The new plant, equipped with 8- to 10,000-gal. kettles, will be designed to produce special resins for fibrous glass, surface coating, foundry, and aviation industries. Reichhold now has 11 other plants in the United States and 23 abroad. Total company sales in 1952 were about $100 million.

The Neville Co., Pittsburgh 25, Pa., has established new warehouses at S. Kearny, N. J., and at Toronto and Montreal, Canada. These new warehouses augment the already established facilities at Los Angeles and San Francisco, Calif. Among other items that will be available in these warehouses are coumarone-indene, modified coumarone-indene, petroleum hydrocarbon resins, and plasticizing oils.

COMPANY NOTES

Catalin Corp. of America, 1 Park Ave., New York 16, N. Y., has elected **Norvin Hewitt Green** as a member of the board of directors. The company also announces the completion of a project for doubling laboratory facilities at its Fords, N. J., and Calumet City, Ill., plants.

American Cyanamid Co.'s Plastics and Resins Div., 30 Rockefeller Plaza, New York 20, N. Y., announces the following appointments: **R. A. Hoekelman** has been named general manager; **Dr. L. P. Moore** succeeds Mr. Hoekelman as assistant general manager; **C. J. Romieux** is now division sales manager, **W. F. Whitescarver,** assistant division sales manager, and **H. B. Freeman,** technical director. Dr. Moore was formerly director of the development division of the company's Stamford research laboratories.

Calco Chemical Div. of American Cyanamid, Bound Brook, N. J., has appointed **James L. Naylor** manager of the Dyestuff Dept., succeeding **J. Pfister.** Mr. Pfister will remain active in the company, devoting his time to the division's New England activities, and will be available for special assignments. Mr. Naylor joined the Calco organization in 1929.

Gemloid Corp., 78-01 Queens Bldv., Elmhurst 73, N. Y., has joined **Nylon Custom Molding Corp.,** 155-45 Linden Blvd., Jamaica 4, N. Y., in the production of industrial nylon components.

Thiokol Chemical Corp., Redstone Div., Huntsville, Ala., is the new name of the organization formerly known as Thiokol Corp.

Celanese Corp. of America has established a new chemical sales office in the Continental Bldg., 3615 Olive St., St. Louis, Mo. Under the supervision of **M. Henry Jamison,** the St. Louis office will be a branch of the Chicago district office, of which **R. J. Werner** is manager.

The General Tire & Rubber Co., Akron, Ohio, has appointed **David Raider & Sons, Inc.,** 97 Spring St.,

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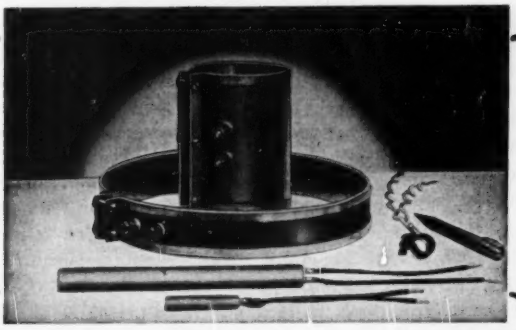

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You'll be surprised at the difference — and the finished job won't cost you a cent more.

With adequate drying your blocking problems will be over, too, especially the blocking that sneaks up on you a week or so after the job has been printed.

We shall be pleased to furnish you with press trial quantities of ADP inks in either process or non-process types.

Our enlarged plastics laboratories for research and sales service stand ready at all times to help you with your problems.

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DISPERSED PIGMENTS CO.

(Formerly Peerless Printing Ink Company)

2250 E. ONTARIO ST., PHILADELPHIA 34, PA.

THE PLASTISCOPE

New York, N. Y., as sales agents to handle its vinyl sheeting in metropolitan New York, eastern New York, eastern Pennsylvania, New England, and Maryland.

Waterbury Companies, Inc., Waterbury 20, Conn., has acquired a substantial stock interest in **Spun Lite Corp.,** 3788 N. W. 52nd St., Miami, Fla. The merger will not effect any change in the manufacturing and sales policies of either company. Spun Lite, founded two years ago as Hoffman Products, Inc., produces corrugated fibrous glass reinforced plastics material. Spun Lite is sold principally to other manufacturers for use in awnings, store fronts, bathtub enclosures, and signs.

H. William Baer, president of Waterbury, has been named president and treasurer of Spun Lite and **Paul Hoffman,** vice president.

Bjorksten Research Laboratories, Inc. has moved its Chicago office and laboratories to 1525 E. 53rd St. **Dr. Edwin L. Gustus,** vice president, will continue to head the branch office.

Hooker Electrochemical Co., Niagara Falls, N. Y., announces a price reduction of 2½¢ per lb. in MPS-500, a plasticizer for vinyl compounds.

The company also reports the following appointments in its research dept.: **Dr. Edward D. Weill** has been assigned to the process research group; **Richard G. Gardella,** as a chemical engineer to the pilot plant group; and **Finn Claudi-Magnussen,** to the resins and plastics group. **Joseph A. Sonia, Jr.,** has been appointed chemical engineer and group leader and **Robert B. Brautigam** chemical engineer, both in process study. **Walter T. George** has been named chemical engineer in the operations department.

Mineral Pigments Corp., Muirkirk, Md., has opened a new office and warehouse at 2225 E. 37th St., Los Angeles, Calif., headed by **George Foos.**

Federal Chemicals Corp., 210 Wythe Ave., Brooklyn, N. Y., is a new company organized for the production of plastisols and organosols. Technical facilities will be at the main plant in Brooklyn and also at the factory of its affiliated company, **Adex Mfg. Co.,** 140 N. Kresson St., Baltimore, Md. Officers of the company are: **Philip M. Liner,** president; **Arthur Mayer,** vice president; **Mortimer E. Stern,** secretary and treasurer; and **Samuel W. Strickman,** long a consultant in the vinyl field and holder of a number of patents, general manager.

Monsanto Chemical Co.'s Plastics Div., Springfield, Mass., announces that **Clark L. Richards** and **Joshua S. Miller** have been promoted to the respective posts of sales manager and assistant sales manager for thermosetting molding materials. **Robert S. Garvie** has been appointed assistant branch manager of the division's New York City office at 445 Park Ave,. and **Robert R. Wilson** to the same position in the New England office at Springfield.

Continental Can Co. has purchased all the outstanding stock of the **Elmer E. Mills Corp.,** Chicago, Ill. The Chicago plant of the Mills organization, producer of plastics bottles, pipe, and tubing, will continue to operate under the supervision and direction of **Mr. Mills.**

Durable Formed Products, Inc., 6 Greene St., New York 13, N. Y., has augmented its forming and fabricating facilities by the addition of molding equipment for fibrous glass reinforced laminating. The company will specialize in the low-pressure molding of pre-impregnated Sunform and Cordopreg glass cloth, utilizing matched metal dies.

Columbia Basin Plastics Co., 1900 S. W. Harbor Dr., Portland, Ore., announces the appointment of **George Anderson** as plant manager. Mr. Anderson was formerly production foreman of Beaman Plastics Products Co.

General Electric Co.'s Chemical Div., Pittsfield, Mass., announces that **Boyette Edwards** has been appointed as an industrial engineer. In his new capacity, he will participate in the division's current intensive program to achieve cost reductions and improve coordination within the several operating units. **Burton B. White** has been named supervisor of rubber sales development for the company's silicone products department at Waterford, N. Y. **Walter F. Brown** has been assigned to the Chicago area as sales representative for G-E's silicone products department. His headquarters will be in the Chemical Div.'s offices at 840 S. Canal St,. Chicago, Ill.

Electric City Box Co., 795 Woodlawn Ave., Buffalo 11, N. Y., has been acquired by **Morris H. Gotthilf.** The company produces plastics jewelry boxes and retail jewelry display units.

Forest Fiber Products Co., P. O. Box 68, Forest Grove, Ore., announces the appointment of **O. W. Frost** as general manager. He will head the sales and manufacturing policies of the company's currently expanding activity. Mr. Frost, who has spent 30 years in wood utilization and development work, designed the construction of the Forest Grove hardboard plant in 1948 and has served as plant manager until his recent appointment.

Farrel-Birmingham Co., Ansonia, Conn., has appointed **Robert C. Brady** as New York office manager. Mr. Brady will headquarter in the F-B office with **A. C. Meyers** of **Consolidated Machine Tool Corp.,** 405 Lexington Ave., New York, N. Y., a wholly-owned subsidiary of Farrel-Birmingham.

Plastics, Laminates & Fabrics, Inc., 4640 W. Fullerton Ave., Chicago 39, Ill., has been recently organized to do silk screening, hot embossing, filling, pantograph lettering, belt sanding, drilling, tapping, and assembly work. The company is also planning to put in facilities to do punching and vacuum forming. President of the new company is **J. R. Hennessey,** who was formerly with Motorola Inc. for 14 years. **Thomas I. Hennessey,** a brother, is vice president and plant manager.

Libbey-Owens-Ford Glass Co. announces the appointment of **Loring V. Warner** as sales manager of the Corrulux Div., with headquarters at 120 S. La Salle St., Chicago, Ill. **Ralph G. Cox** has been promoted to district manager of the Fiber Glass Div. for the southeastern region with offices at 319-22 Professional Bldg.,

Now you can injection-mold vinyl chloride products

with HEAT-STABLE OPALON DRY BLEND MATERIALS

Typical products molded at lower cost of Opalon include electrical cord plugs, automobile parts, toys, sporting goods, some types of housewares, grommets and snubbers, bumpers for appliances, binding for luggage, and many others.

Here's big news of interest to you. Monsanto has developed a series of revolutionary new vinyl chloride injection molding materials whose excellent heat-stability now make it *practical and profitable* for you to mold vinyl using your present equipment.

Based on Monsanto's Opalon 300 dry blend resin, these new materials have many molding advantages over regular vinyl injection molding compounds, including:

1. Superior heat-stability because of no previous heat history
2. Faster molding cycles
3. Less critical to mold

For molders who would like to mix their own injection molding compounds by dry blending, Opalon 300 offers real savings in *low* conversion costs.

Write today for full information on Monsanto's new Opalon vinyl chloride materials for injection molding. The coupon is for your convenience. Opalon: Reg. U.S. Pat. Off.

PROPERTIES OF OPALON DRY BLEND MATERIALS

1. Flexibility ranges from gum rubber to hard rubber consistency.

2. Resistance of plasticized-Opalon dry blend compounds varies according to resistance of the plasticizer as well as vinyl resin. Opalon compounds are resistant to moisture, oxidation, most acids and alkalies, common organic solvents and petroleum.

3. Can be formulated as opaque, translucent or transparent compounds, and can be pigmented over a complete range of permanent, vivid colors.

4. Can be obtained in high gloss or semi-gloss formulations.

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THE PLASTISCOPE

403 N. Tryon St., Charlotte, N. C.

The company's Corrulux Div. has recently added 22 new distributor warehouses in the midwestern states. Distributor appointments in the western region were doubled in the first half of 1953.

Metro-Atlantic, Inc., Centredale, R. I., has added **Everett J. Clark** and **I. Peters** to the company's sales staff. Mr. Clark has an extensive background in the supervision of textile printing operations. Mr. Peters has been associated with the textile processing industry since his entry into business in 1939.

Pittsburgh Plate Glass Co., 632 Ft. Duquesne Blvd., Pittsburgh 22, Pa., has appointed **Daniel P. Wedel, Carl R. Faelten**, and **John Bond** as district sales managers to handle its Selectron resin products in Milwaukee, Wis., Newark N. J., and Torrance, Calif., respectively. The appointees will continue to operate under the supervision of **Dr. E. H. Haux**, general sales manager of Selectron resin products in Pittsburgh.

Sill Industries, Maplewood, N. J., sales representatives and distributors, have been appointed by **Carbomatic Corp.**, Freeport, N. Y., to handle its entire line of gas-fired heating equipment. Sill Industries thus adds a line of gas processing heaters to a line of electrical radiant heating panels which they have been marketing for the past five years.

Bakelite Co., Div. of Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y., announces the appointment of **J. E. Brister** as manager of the Molding and Extrusion Materials Department. He will be responsible for the sale of all molding and extrusion materials, including phenolics, polystyrene, polyethylene, and vinyls used for these applications, as well as wire and cable materials. He joined the company in 1933 and was formerly manager of the Wire and Cable Materials Div., succeeding John D. Benedito who was recently named assistant general sales manager. **Albert E. Maibauer**, formerly assistant to the manager of the New York Sales Development Group, succeeds Mr. Brister as manager of the Wire and Cable Materials Div. He joined the company in 1925.

PERSONAL

Philip A. Belk, advertising manager of **Hercules Powder Co.'s Plastics Div.**, Wilmington 99, Del., has been named chairman of the public relations committee of the **Society of the Plastics Industry.**

Earl W. Diener, formerly district sales manager of **Titanium Pigment Corp.**, 111 Broadway, New York 6, N. Y., has been appointed Eastern sales manager, succeeding the late John A. Lutz.

Roy Carson is now sales manager of **Chippewa Plastics, Inc.**, 210 E. Columbia St., Chippewa Falls, Wis. Mr. Carson was formerly associated with Penick & Ford, Ltd., Inc. and Solvay Process Div., Allied Chemical & Dye Corp.

James C. DeShazor, Jr., one of the former partners of Beaman Plastics Products Co., announces that he has taken over the plant of that company as of June 1 and will operate under the name of **Columbia Basin Plastics Co.** at 1900 S. W. Harbor Dr., Portland, Ore. Facilities of the new company include its own tool and die shop and equipment for all types of plastics molding, fabricating, and finishing.

James W. Hendry has been promoted to assistant vice president in charge of plastics machine development of **Jackson and Church Co.**, Saginaw, Mich. In his new capacity, he will be responsible for further development of current models and new molding equipment and processes.

Dr. George C. Schweiker has been assigned to the resins and plastics research group of **Hooker Electrochemical Co.**, Niagara Falls, N. Y.

Thelma E. Beaman, formerly one of the co-owners of Beaman Plastic Products Co., is now independently operating under the name of **Beaman Plastics**, 1701 N. E. Davis St., Portland 14, Ore. The company is equipped to handle all types of compression and injection molding.

Martin C. Hutt, formerly sales manager of the Fiber Glass Div., Ferro Corp., Nashville 20, Tenn., has opened offices under the name of **Martin C. Hutt Sales** at 136 Front St., Berea, Ohio. Mr. Hutt will specialize in fibrous glass materials and will represent Ferro Corp., Modigliani Glass Fibers, Inc., and Hoffman Products in Ohio, Michigan, and western Pennsylvania.

MEETINGS

Aug. 27—Society of the Plastics Industry, Leominster - Worcester Chapter Annual Golf Outing and Dinner, Wachusett Country Club, W. Boylston, Mass.

Sept. 6-11—American Chemical Society, 124th National Meeting, Hotel Conrad Hilton, Chicago, Ill.

Oct. 8-9—Society of the Plastics Industry, New England Section Meeting, Equinox House, Manchester, Vt.

Oct. 27—Association of Consulting Chemists and Chemical Engineers, Inc., Annual Meeting and 25th Anniversary, Hotel Belmont Plaza, New York, N. Y.

Nov. 9-12—Refrigeration Equipment Manufacturers Association, Refrigeration and Air Conditioning Exposition, Public Auditorium, Cleveland, Ohio.

Nov. 30-Dec. 5—Chemical Industries Exposition, Commercial Museum and Convention Hall, Philadelphia, Pa.

Dec. 3-4—Society of the Plastics Industry, Fifth Film, Sheeting, and Coated Fabrics Div. Conference, Commodore Hotel, New York, N. Y.

Dec. 13-16—American Institute of Chemical Engineers, Annual Meeting, Hotel Jefferson, St. Louis, Mo.

S. P. E. Meeting

Sept. 9—Robert Butzko, Auto Vac Co. will address the Newark section on "vacuum forming." R. W. Birney, Consolidated Molded Products, will talk on "Quality Control in Plastics."

Oct. 14—Thomas Harris, manager of Cargo Sales for American Airlines will address the Newark section on "The Potential Market of Plastics."

Vol. 1
No. 1

Advance Info

Published by ADVANCE SOLVENTS & CHEMICAL CORP.

One of a Series on Production Aids — Clip and Save for Reference

NEW PLASTICIZER FOR VINYL COMPOUNDING

Plastoflex MGB Exhibits Strong Solvent Action and Imparts Higher Tensile Strength on PVC Resins

A significant new development in plasticizers for vinyl chloride resins has been announced by the research and development laboratories of Advance Solvents & Chemical Corporation.

Called *Plastoflex MGB*, this new non-phthalate primary plasticizer has a low volatility and a very strong solvent action that marks it with special interest for vinyl compounders generally. It is also compatible with a great variety of other polymers used in the coating industry.

Tensile strength of vinyl compounded with new Plastoflex MGB is considerably greater than that made with DOP.

MGB Readily Available

Chemically, *Plastoflex MGB* is a modified poly-propylene glycol dibenzoate. This is important to all plasticizer consumers, because this product is not dependent on phthalic anhydride which has been so critically short in past years and therefore of uncertain availability.

In Plastisols, the viscosity is obtained and maintained unchanged for prolonged periods. Interesting rheological properties of plastisols prepared with *Plastoflex MGB* are obtained and compare very favorably with plastisols prepared with more expensive plasticizers.

Because of the greater hardness of PVC compounds containing *Plastoflex MGB* as compared with the use of equal quantities of dioctyl phthalate, this new plasticizer should be of special interest to VINYL TILE compounders.

Tests Prove Advantages

Test results in certain resins show the following advantages over DOP compositions:

Greater tensile strength
Higher modulus of elasticity
Higher boiling point
Lower vapor pressure
Lower volatility

If cooled below minus 30° C, *Plastoflex MGB* will not crystallize, but will solidify to a clear glass-like solid.

Laboratory tests proving greater effectiveness and low cost of Plastoflex MGB have been amply substantiated by extensive production use.

Importantly, *Plastoflex MGB* has been found to yield exceptional results with various Advance Stabilizing systems and also good results with other types of stabilizers.

Plastoflex MGB should, therefore, definitely prove of real interest to manufacturers of vinyl tile and plastisol compounds, as well as of artificial leather, plastic toys and vinyl films; also, to users of other film formers, such as ethyl cellulose, cellulose acetate-propionate, cellulose acetate-butyrate, and nitrocellulose.

COMPARISONS PROVE PLASTOFLEX MGB SUPERIOR IN TESTS MADE ON DIFFERENT VINYL RESINS

	100 p. Geon 101		100 p. VYNW	
	50 p. MGB	50 p. DOP	50 p. MGB	50 p. DOP
Tensile Strength psi	3510	2300	3650	3300
Elongation %	385	350	320	290
100% Modulus psi	2100	1600	2060	1850
Shore Hardness	90	85	90	85

(Note—Improved low temperature flexibility can be obtained with mixtures of equal amounts of Plastoflex MGB and DOP, about equal to the low temperature flexibility of resins plasticized with DOP alone.)

COMPLETE TECHNICAL DATA AND SAMPLES WILL BE SENT UPON REQUEST ON ALL PRODUCTS MENTIONED IN ADVANCE INFO

ADVANCE SOLVENTS & CHEMICAL CORP. 245 Fifth Avenue, New York 16, N.Y.

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HYDRAULIC PRESSES: 1—Clearing 500 Tons, completely self-contained with controls for manual or automatic operation, suitable for compression and injection molding. 1—Farrell, 390 Tons, 48"x48" steam platens, 2 openings, 4 rams—10" diam. x 24" stroke, approx. 15" per opening. 1—Watson-Stillman, 100 Tons, 11¾x12" platens, 22½" DLO, ram—8" diam. x 15" stroke. 1—Watson-Stillman, 100 Tons, down-acting, 22"x20" bed area, 24" DLO, ram—11½"x9½"x8" stroke, self-contained; complete with 15 HP MD Vickers Pump. Unit is practically new. 1—HPM, 100 Tons, 18"x18" Platen Area, ram 8" diam. x 18" stroke, 30" DLO, Steel Cylinder—4000 PSI. 2—Burroughs, 75 Tons, down-acting, 17½"x17" electric-heated platens, 13½" DLO, ram—8" diam. x 10" stroke complete with 7½ HP MD Oilgear Pump. 1—Watson-Stillman, 50 Tons, down-acting, platen area 25"x25½", 25" DLO, ram—8" diam. x 14" stroke, complete with 7½ HP MD Pump. 1—New Laboratory Press, 12 Tons, Hand Operated, fitted with 8"x8" electrically heated platens. 3—Denison, 4 Tons, Model FH4-CO1, down-acting ram—3¼"x2"x12" stroke, 18" DLO, bed 22"x14", 8⅛" throat, complete with 3 HP MD Pump, time delay control, all valves, piping, gauges, controls. 1 machine slightly used, 2 units still in original crates. 1—Standard Machinery Co. #14 Toggle Press, 150 Tons, platen area 34"x28", 6" DLO, 3½" Stroke, arranged for Motor Drive, practically new. ALSO: Plastics & Rubber Extruders, Mills, Mixers, Grinders, Injection Molding Machines, Pumps, Valves, Platens, etc. JOHNSON MACHINERY COMPANY, 683 Frelinghuysen Avenue, Newark 5, New Jersey. Bigelow 8-2500. What have you for sale? What you looking for?

FOR SALE: Quick delivery Rubber and Plastic Equipment. Farrell 16" x 48", and 15" x 36", 2 roll rubber mills. Other sizes up to 84". New Seco 6" x 12" and 6" x 16" Lab. Mixing Mills and Calenders. Rubber & Plastic Extruders. Stokes #280, 4" diam. Preform Machine. W.S. 300 ton downstroke Hydr. Press, 30" x 30" Platens self contained. 350 ton 22" x 24". New Loomis 340 ton & 50 ton Hydr. Presses. 24" x 56" Platens. 200 ton Brunswick 21" x 21" Platens, 14" Ram, Record Presses. W.S. 150 ton 30" x 60". 100 ton 24" x 24". Elms 75 ton 30" x 36". Also presses Lab. to 2000 tons from 12" x 12" to 48" x 48". Hydr. Oil Pumps. Gould 75 HP motor Dr. 2 stage Centrif. Pump. 250# W.P. W.S. 4 Pigr. High and Low Pressure Hydr. Pump. HPM 5 GPM 2700 lbs. Elmes Hor. 4 Pigr. 4500 lbs. and 5500 lbs. Hydr. Accumulators. Stokes Automatic Molding Presses. Rotary & Single Punch Preform Tablet Machines ½" to 4". Injection Molding Machines 1 oz. to 32 oz. Baker Perkins Jacketed Mixers 100, 50, and 9 gal. Plastic Grinders. Heavy duty mixers, grinders, pulverizers, gas boilers, etc. Partial listing. We buy your surplus machinery. STEIN EQUIPMENT CO., 107-8th Street. Brooklyn 15, N.Y. STerling 8-1944.

SAVE WITH GUARANTEED REBUILT EQUIPMENT: HYDRAULIC PRESSES: 42" x37" 20" ram, 475 tons; 2-7 opening 27"x27", 18" ram, 565 tons; 24"x24" 12" ram, 170 tons; 24"x20" 10" ram, 118 tons; 20"x20" 10" ram, 118 tons; 20"x20" 10" ram, 200 tons; 30"x20" 8" ram, 75 tons; 24"x20" 8" ram, 75 tons; 14"x14" 8" ram, 75 tons; 15"x15" 8" ram, 75 tons; 2-19"x24" 10" rams, 78 tons; 12"x12" 6½" ram, 50 tons; 14"x14" 8" ram, 50 tons; 8"x9½" 4½" ram, 20 tons; 16"x16" 3½" rams, 12 tons; PREFORM PRESS: Colton 5½T, Reeves Drive and Motor; LABORATORY PRESSES: Carver & Watson Stillman Units; NEW UNIVERSAL DUAL PUMPING UNITS: 3-15 HP; NEW LABORATORY MILLS, and CALENDERS; EXTRUDER: Modern Plastic 1½"; ACCUMULATOR: HPM 6" ram 2500#, also Mixers, Vulcanizers, Injection Molding Machines, etc. UNIVERSAL HYDRAULIC MACHINERY CO. INC., 285 Hudson Street, New York, 13, N. Y.

FOR SALE AT GREAT SAVINGS
Colton 2RP and 3RP Rotary & 4T Tablet Machines. Day 40x120 Single Deck Sifter. Great Western—all models. Mikro Bantam, 1SH, 2TH, 3W, 3TH, 4TH Pulverizers; Schutz O'Neill Mills. Baker Perkins Heavy Duty Steam Jacketed, Double Arm from 12 to 150 gal. Mixers. (Unidor and Vacuum also) J. H. Day, from 4 up to 75 gal., Imperial and Cincinnatus, D. A. Jacketed, Sigma Blade Mixers. Day & Robison Dry Powder Mixers, 100 up to 10,000 lbs. Package Machy, FA, FA4, Miller, Hayssen 3-7, Scandia auto, Wrappers. Hudson Sharp Campbell auto. Cellophane Wrapper.
REBUILT AND GUARANTEED—This is only a partial list. Over 5000 machines in stock—available for immediate delivery. Tell us your machinery requirements.
UNION STANDARD EQUIPMENT CO.
318-322 Lafayette St., New York 12, N. Y.

PARTIAL LIST of available machines, may be inspected in operation: 4 ounce new, our own machine. 60 ounce Jackson & Church, used 1 week $37,500. 48 ounce DeMattia w/preplasticiticer. 48 ounce Lester, almost new. 32 ounce Reed-Prentice, new 1950. 24 ounce Reed-Prentice 1950, $26,000. 22 ounce Impco vertical. 22 ounce Reed-Prentice, new 1948, $23,000. 16 ounce Monson, used very little, $16,500. 16 ounce H.P.M., 1947, $16,500. 12 ounce Lester, $9,500. 12 ounce H.P.M., new 1941, $6500. 12 ounce Lester, Model 2½L, $12,500. 8 ounce H.P.M., new 1941, $7,000. 8 ounce Lester, Model 2½L, new 1949, $12,500. 8 ounce Watson-Stillman, 1944, $7,000. 8 ounce Reed-Prentice, 1941, $8,500. 4 ounce Reed-Prentice, 1941. 4 ounce Lester, $4,000. 4 ounce Lewis, 6 mos. old, $6,500. 3 ounce Fellows, 2 years old. 2 ounce Watson-Stillman vertical. 2 ounce Fellows. 3—50 ton hydraulic presses used for making records. Vacuum Plating machine 4' rotary. We also have available several compression, transfer and preform presses.
ACME MACHINERY & MFG. CO.
P.O. Box 731, 102 Grove St., Worcester, Mass.

FOR SALE: 1—#1A Banbury Mixer 100/50 HP motor; 1—Thropp 18"x50", 2 roll Mixing Mill, 75 HP motor; 1—Baker Perkins 50 gallon double arm jacketed Vacuum Mixer 50 HP motor; 2—Baker Perkins 100 gallon jacketed double arm Mixers; 1—Patterson 5' diam. Conical Blender; 1—Robinson 4000# Heavy Duty Powder Mixer; 1—Ball & Jewell #2½ Rotary Cutter; 1—#2TH Stainless Steel Mikro Pulverizer; 4—Buflovak 20 shelf Vacuum Dryers; 3—Rotex Sifters 40"x84" double deck; 6—Stokes Rotary Preform Presses DD2, DDS2, D4, D3 and B2; 1—Vickers Hydraulic Pump 27 GPM at 1000# pressure. Partial Listing. Write for details. We purchase your surplus equipment. BRILL EPUIPMENT COMPANY, 2407 Third Avenue, New York 51, N. Y.

FOR SALE: Reinforced Plastics Press 54"x 144" PL-Injection Presses: 32 oz. and 24 oz. Reeds (1948), 4 & 9 oz. HPM, 8 & 16 oz. Lester, 6 oz. Watson, 1 & 2 oz. VanDorn, 4 oz. Makray-Extruders: 1½" NRM, 1¼"MPM w/crosshead, 1 Royle Oilheater, Conveyor 22'x 12". Scrap grinders, Ovens. Transfer & Compress. Presses. Preform presses: Colton 4½, Stokes 280C, Kux 25. 42" Slitting & Rewind. mach. 3 HP Gasboilers. List your equipment with me for prompt action. JUSTIN ZENNER, 823 Waveland Ave., Chicago 13, Ill.

WE HANDLE HYDRAULIC PRESSES, pumps and power units of all sizes. Write us your requirements and we will try to help you. We find it impossible to list our equipment in this classified column due to the fact that the equipment is sold before ad is published. For those who seek action look in the New York Times under the Machinery and Tool Column for our regular Sunday Special. HYDRAULIC SAL-PRESS, INC., 386-90 Warren Street, Brooklyn 2, N. Y. MAin 4-7847.

FOR SALE: 1—6"x12" Lab. Roller Mill; 1—Baker Perkins Banbury type 10 gal. Mixer, with pressure cover, m.d.; 4 Bolling 18"x18" 5-opening Hydraulic Presses; 1—HPM 4-oz. Injection Molding Machine; 2—Ball & Jewell Rotary Cutters; 1—100 gal. Patterson Kneadermaster S/S Mixer; 1—Eureka Rotary Cutter; 1—500 gal. Patterson Reaction jack. agit. Resin Kettles; 7—Dry Mixing Blenders, up to 11,000#; 1—NRM 1" electric heated Plastic Extruder; 2—Day Roball 82 Sifters, 40"x120" screens; 2—Rotex #12, 20"x37" screens; 1—Retex 30"x48" Sifter; 3—Mikro Pulverizers 2TH, 3TH, 2DH. Also Grinders, Extruders, Compression and Injection Molding Presses, etc. Send us your Inquiries. Advise us what you have for sale. CONSOLIDATED PRODUCTS CO. INC., 13-14 Park Row, New York 38, N.Y. BArclay 7-0600.

USED ELECTRONIC HEAT SEALERS
Extensive stock—½ KW to 20 KW—Rebuilt—guaranteed—Special—2 KW Radio Receptor Thermatron with P-18 press complete $1250. List $2000. Rebuilt, retubed, refinished. Guaranteed. Many others. Send for current Bargain List. State your wants.
THERMASTER DIVISION
SEWARD INDUSTRIES, INC.
68 18th St., Brooklyn 32, N. Y.
Phone: St. 8-4371

INJECTION MOLDING MACHINES in good operating condition: One 24 oz. Reed-Prentice; Three 22 oz. Reed-Prentice; One 22 oz. Impco; One 16 oz. HPM; One 16 oz. Munson; Four 12 oz. Reed-Prentice; Two 12 oz. Watson-Stillman; Four 12 oz. Lester-Phoenix; Ten 8 oz. Reed-Prentice; Four 8 oz. Lester-Phoenix; One 8 oz. Leominster; Two 4 oz. Reed-Prentice; One 4 oz. HPM; One 4 oz. Lester-Phoenix. Reply Box 927, Modern Plastics.

FOR SALE: 1 Foremost Grinder for plastics with a 25 H.P. motor. Will shred or grind any type of poly or plastic or vinyl scrap.—1 Jeffrey Swing Hammer Shredder with a 30 H.P. motor and controls. Used to pulverize any material. In excellent condition. A 2 oz. Moslo Injection Molding Machine. ROART CO., 830 Monroe St., Hoboken, N. J.

STOKES ROTARY Pellet Presses—RD-3 and RDS-3; Kux model 25 Rotary Press; Ball & Jewell Stainless Steel Rotary Cutter #1½; Mikro Pulverizers #1-SH, #1-SI, #2-TH, #2-SI. Large stock steel and stainless steel tanks and kettles. PERRY EQUIPMENT CORP., 1429 N. 6th St., Phila. 22, Pa.

10D—12 oz. REED PRENTICE INJECTION MOULDER. Almost new. In Los Angeles area. Made Oct. 1950 but less than 2 years service on single shift. Shut down in June. Excellent condition. Best cash offer to RADIANT RAY LIMITED, 4100 Sperling Avenue, Vancouver, Canada.

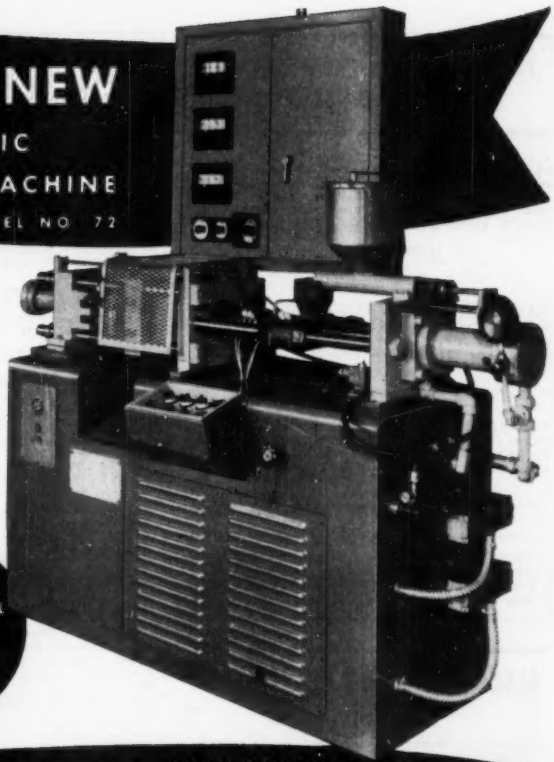
FOR SALE: 9 ounce H.P.M., new in 1946, 8 ounce Reed-Prentice, new in 1946, each machine $9,500, located on West Coast. ACME MACHINERY & MFG. COMPANY, 102 Grove Street. Worcester, Mass. Telephone 7-7747.

(*Continued on page* 230)

ANNOUNCING THE NEW

2 OUNCE MOSLO HYDRAULIC PLASTIC INJECTION MOLDING MACHINE

MODEL NO 72



Here is the Moslo 2 Ounce Horizontal Hydraulic Plastic Molding Machine you have been waiting for, to do production molding of small pieces with low mold cost. Built along the lines of larger machines it will shoot a 2 ounce plus shot, and will hold better than 20½ square inches of molding area. Our special 4 Point Toggle Clamp with calibrated adjusting nuts for mold alignment together with the famous Moslo "Radee" Cylinder of stainless or nickel steel guarantees the above statement.

OTHER FEATURES ARE

Dry Run 525 Cycles
Manual, 1 cycle and Repeat cycle performance
25 lbs Material Plasticizing Capacity
8 x 9 Std. D.M.E. Mold blanks
7" Injection stroke
1⅛" Injection Ram water cooled
12,100 PSI Max Pressure
14 lb Material Hopper
Vickers Pump Equipment
Taco West Heat Control Inst.
5 H.P. Motor

Write for additional and full information.

OTHER MODELS:

Model 40 ¾ Oz Hand
Model 50 ¾ Oz Vertical Hyd
Model HC75 ¾ Oz Hydraulic
Model 71 1 Oz Horizontal Hydraulic
Moslo 2 ½ Oz Duplimatic

WRITE FOR ADDITIONAL AND FULL INFORMATION

MOSLO MACHINERY COMPANY 2443 PROSPECT AVE. CLEVELAND 15, OHIO

Removes Wrinkles and Creases from sheets and films on all types of machines!

Mount Hope ADJUSTABLE EXPANDERS

Now You Can Adjust Your Expander Bow During Operation!

This revolutionary new Ball Bearing Free Wheeling Expander adjusts easily, quickly—to fit your exact requirements from 0 to maximum bow required—with your machine running at full speed if desired. For all types of fabrics on all types of machines—removes wrinkles and creases before entering next machine. Holds to full width all tire-cord, paper, rubber, plastic films and all types of fabrics.

Retains all efficiency features of regular Mount Hope Ball Bearing Free Wheeling Expanders. Tops for experimental purposes, ideal as a spare—it adapts to do the work of any number of fixed bow devices.

Write Dept. M for information—or have a Mount Hope Engineer advise you—no obligation.

MOUNT HOPE MACHINERY COMPANY
15 FIFTH STREET, TAUNTON, MASSACHUSETTS

THOSE WHO KNOW CONSULT *Manco!*

These medallions are being molded by the Ford Motor Company and given away as souvenirs in the Ford Rotunda during their 50th anniversary.

Shown are the master steel hob, furnished by The Union Steel Stamp and Die Engravers, Detroit; the TRU-CAST Beryllium Copper Cavity; and the plastic medallion.

Note the exacting reproduction, the clean, sharp fidelity. More than 2000 satisfied customers attest that for the best you specify

MANCO TRU-CAST BERYLLIUM COPPER CAVITIES AND CORES

Write today for new brochure.

BERYLLIUM COPPER AT ITS BEST
TRU-CAST by MANCO

MANCO PRODUCTS,
2403 Schaefer Rd. Melvindale, Mich.
Telephone—Detroit: WArwick 8-7411

CLASSIFIED ADVERTISING

(*Continued from page 228*)

FOR SALE: Lester twelve ounce injection molding machine. Extra equipment. Prompt delivery. New in 1948. May be seen in operation. Good condition. Priced for quick sale. E & W PLASTICS, 447 W. Cedar Ave., Akron 7, Ohio.

HAVE TWO Watson-Stillman 16-oz. Injection Heating Cylinders available in good operating condition. Price—$750. Model number 9759. Reply Box 906, Modern Plastics.

FOR SALE: 1940 Reed Prentice Molding machine recently overhauled. Price $5600.00. PLAST-O-MATIC CORP., 37 Spruce Street, Leominster, Mass.

NEW ACME 4 ounce injection molding machine. For information, ACME MACHINERY & MFG. CO., 102 Grove Street, Worcester, Mass. Telephone 7-7747

MACHINERY and EQUIPMENT WANTED

WANTED: Heating cylinder for Reed-Prentice two ounce molding machine Model 10A, 1938 year. Reply Box 922, Modern Plastics.

WANTED: Plant or Machinery including Rubber Mills, Hydraulic presses, Sturdy mixers, Calenders, Banbury mixers, Pulverizers, Grinders, Rotary cutters, Extruders, Screens, Injection Molding machines, Dryers. CONSOLIDATED PRODUCTS CO. INC., 13-14 Park Row, New York 38, N. Y. BArclay 7-0600.

WANTED TO RENT: a late model 8 ounce Reed-Prentice injection molding machine. Reply Box 923, Modern Plastics.

WANTED: Banbury Mixers, Heavy Duty mixers, Calenders, Rubber Rolls & Mixers, Extruders, Grinders & Cutters, Hydraulic Equipment, Rotary and Vacuum Shelf Dryers, Injection Molding Machines. Will consider an operating or shut down plant. P. O. Box 1351, Church Street, New York 8, N. Y.

WANTED: Plastic injection moulding machines. Get our offer before you sell. ACME MACHINERY & MFG. CO., 102 Grove St., Worcester, Mass.

MATERIALS FOR SALE

VINYL PLASTIC FILM AND SHEETING top mill assortments, in widths 24" to 54", in gauges .0015 to .020, plains and embossings in various colors. These goods are all virgin, first quality closeouts. We carry a large inventory at all times for sale at low prices. Confidential inquiries invited; samples gladly sent on request. Reply Box 915, Modern Plastics.

FOR SALE: Vinyl & Polyethylene virgin & scrap, all types. AMERICAN VINYL CORP., 38-01 23rd Ave., Long Island City 5, N. Y. AStoria 4-1768.

FOR SALE
18,000 lbs. Red Vinyl Pellets
20,000 lbs. Reground Black Vinyl
20,000 lbs. Reground VG 1947 Natural Vinyl
6,000 lbs. Virgin Baby Blue Hi-Impact Polystyrene
6,000 lbs. Reground White Hi-Impact Polystyrene
6,000 lbs. Reground Gray Hi-Impact Polystyrene
6,000 lbs. Reground Pink Hi-Impact Polystyrene
6,000 lbs. Reground Standard Green Polystyrene
2,500 lbs. Virgin Pearl Cellulose Acetate
2,500 lbs. Virgin Amber Lucite HM140
CLAUDE P. BAMBERGER, INC.
152 Centre Street B'klyn 31, N. Y.
Tel: Main 5-5553
Not connected with any other firm of similar name.

MATERIALS WANTED

WANTED: PLASTIC SCRAP OR REJECTS in any form. Also surplus and obsolete lots of virgin molding powders. We also custom reprocess your own scrap. A. BAMBERGER CORP., 703 Bedford Ave., Brooklyn 6, N. Y. Telephone: MAin 5-7450.

WANTED: Plastic Scrap, Rigid Vinyl, Cellulose Acetate, Polystyrene, Polyethylene, Butyrate, Custom grinding, magnetizing, compounding, and straining of contaminated plastics. FRANKLIN JEFFREY CORPORATION, 2004 McDonald Avenue, Brooklyn, N. Y., ES 5-7943.

WANTED: PLEXIGLAS—LUCITE—in clear —West Coast Dealer wants large quantities sheet stock and cut-offs, all thicknesses. Must be attractively priced. Pay cash. Reply Box 929, Modern Plastics.

WANTED: PLASTIC SCRAP or REJECTS in any form: Cellulose Acetate, Butyrate, Polyethylene, Polystyrene, Vinyl, Acrylic, Ethyl Cellulose. Reply Box 902, Modern Plastics.

WANTED: Plastic scrap, rigid and flexible vinyl; also polyethylene, any type. AMERICAN VINYL CORP., 38-01 23rd Ave., Long Island City 5, N. Y. AStoria 4-1768.

WANTED: SURPLUS UREA molding powder. Reply Box 901, Modern Plastics.

MOLDS FOR SALE

FOR SALE AT 40% of present cost, efficient Molds and Production Fixtures for six popular New Toy Items. Sales market barely exploited on all items, some inventory of component parts available, will consider installment contract with proper parties. Information and samples on request. Write P.O. BOX 25, Roosevelt Station, Dayton 7, Ohio.

FOR SALE: 1—4 cavity baby brush mould. 1—brush and mirror mould. 1—cover mould for miniature piano cigarette box. ROART CO., 830 Monroe St., Hoboken, N. J., HOboken 2-2020, 2021.

INJECTION MOLDS For BUTYRATE DOLL HEADS. Reasonable. HORSEMAN DOLLS, INC. P.O. Box 1890, Trenton, N. J.

FOR SALE: One Injection-Type 6-cavity (3-units) special designed beautiful Soap-Box Mold; One 8-cavity (4-units) new type, low priced Cigarette Case to hold 20-regular size Cigarettes, as well as several other Molds. All Molds to fit the 8-ounce Reed-Prentice or any other injection Machine. Molds are guaranteed almost new, and in the most perfect economical working conditions for immediate possession. Reply Box 934, Modern Plastics.

SINGLE CAVITY FUR COAT HANGER suitable for 8 oz. injection molding. Cheap. Reply Box 924, Modern Plastics.

MOLDS WANTED

HOUSEWARES AND GIFT item molds wanted for injection molding. Will buy or trade for lamp part molds or other molds we have available. Send complete detailed information of what you have to offer to: SUPERIOR PLASTICS, INC., 426 No. Oakley Blvd., Chicago 12, Ill.

MOLD WANTED for injection molding. We will buy one mold or a complete line or series of molds for finished resaleable items. Housewares, toys, novelties, etc. Will also buy molds for industrial parts such as handles, knobs, drawer pulls, gears. All items for resale in U. S. A. Send detailed information to VICTORY MANUFACTURING COMPANY, 1722 W. Arcade Place, Chicago 12, Illinois.

MOLD WANTED FOR CAKE KNIFE. Will also consider molds for any other housewares items. Send details and samples.—SUPERIOR PLASTICS, Inc., 426 N. Oakley, Chicago 12, Illinois.

PLANT FOR SALE

FOR SALE
Complete wood flour mill. Capacity 10 tons per 24 hours, using nearby supply of pine and poplar. For further particulars, reply Box 904, Modern Plastics

PLANTS WANTED

PLASTICS PLANTS WANTED. Going Business, Volume $300,000 to $3,000,000: Consumer-Proprietory or Industrial Products: We represent a Leading Nat'l. Corporation: Seeking Diversification & Expansion into new fields and Territories. Sizeable Investments Preferred: Name of Company on request: Competent and Confidential Dealings. GOLDEN INDUSTRIAL AGENCY, 2189 Gr. Concourse, N. Y. 53.

HELP WANTED

EXTRUSION FOREMAN—MUST be EXPERIENCED on tubings, Rods and Shapes. Familar with Acrylics and Acetate Materials. Good opportunity. N. Y. area. State qualifications. Reply Box 919, Modern Plastics.

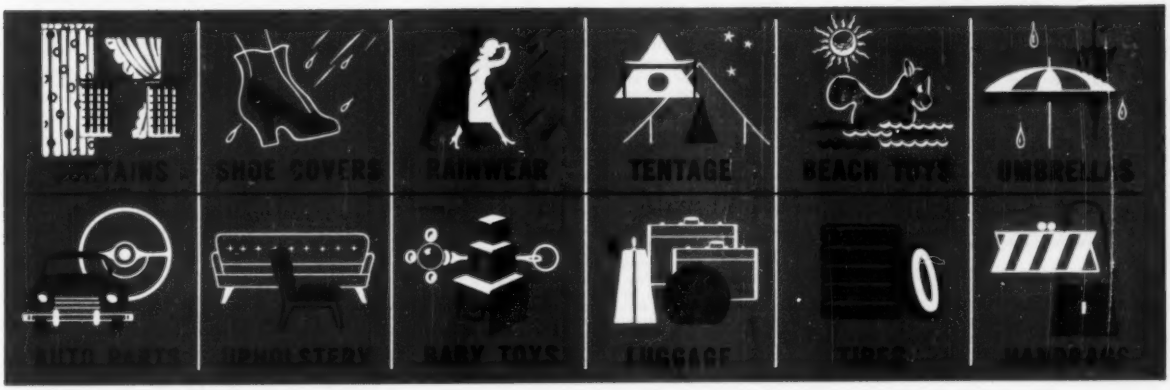
ASSISTANT PRODUCTION MANAGER for Plastic Fabrication Plant. Must know Thermoplastic Forming. Have Vacuum Forming equip. and all other processes. Salary open. Location in Southeast. Reply Box 913, Modern Plastics.

(*Continued on page 232*)

Drew produces a choice of Plasticizers for use in manufacturing a wide range of products requiring toughness, permanence and flexibility under extreme heat and cold. Outstanding among these Drew quality products is PLASTICIZER SC.

SC Offers extreme flexibility under extreme heat or cold, and assures reliability and permanence in the finished product. SC promotes wetting and dispersion of filler in production. Exceptionally stable and resistant to oxidation and rancidity, it is widely used in Vinyl Resins for high plasticizing action down to temperatures as low as —70°F.

Recommended for a wide variety of applications, including embossed surfaces, fabric coatings such as raincoats, tenting, car covers; shoe soles, wire and cable insulation, medical tubing, etc. SC is easily emulsified, and can be conveniently added to aqueous dispersion of synthetic resins and rubbers.



OTHER DREW PLASTICIZERS OFFER OUTSTANDING PROPERTIES

DP 200

An excellent all-purpose plasticizer with exceptionally low heat loss and low "sweat-out". Provides plastic action down to –50°F. DP 200 gives low brittle points to vinyl chloride plastics. Low viscosity—ideal as softener for synthetic rubber manufacturing.

DP 250

A light colored, low viscosity polymeric type plasticizer which retains the easy handling properties of lower weight monomeric types. Affords good low temperature flexibility, excellent resistance to heat and light aging. Very resistant to leaching action of oils. Produces good results as an aid in pigment wetting and grinding, extrusion and calendering.

DP 520

The protein plasticizer. Gives products flexibility, clearness, toughness, permanence and exceptional stability against humidity. Low susceptibility to heat or cold. Compatible with natural or synthetic resins. The plasticizer for casein, zein, soybean protein and synthetic rubber compounds. Ideal for making coatings, adhesives, impregnants, inks and other protein base products.

For complete details and technical data on all Drew Plasticizers, call or write

DREW PRODUCTS

TECHNICAL PRODUCTS DIVISION

E. F. DREW & CO., Inc.

15 EAST 26th STREET, NEW YORK 10, N.Y.

BOSTON • PHILADELPHIA • CHICAGO

CLASSIFIED ADVERTISING

(Continued from page 230)

WANTED
Graduate chemist or chemical engineer
Age 25-35
EXPERIENCED
In the compounding and extrusion of various plastics in the wire and cable industry.
EXCELLENT OPPORTUNITY
For man desiring a permanent, secure and responsible position in New England. Please send complete resume with first letter.
Reply Box 931, Modern Plastics.

ENGINEER-FOREMAN to assume responsibility for experimental, tooling and production of reinforced plastic product. Must have thorough knowledge of polyester-fiberglass laminating techniques. Good opportunity in an established firm in a southwestern state. Submit resume of work experience and salary expected to Box 914, Modern Plastics.

ASSISTANT PLANT MANAGER for leading film and sheeting plant—thoroughly experienced—excellent future. State experience, age, salary, and full details. Reply Box 928, Modern Plastics.

LARGE COMPANY has opening machine designer preferably with knowledge of extruding dies, blowing dies, rotational molding. Reply Box 916, Modern Plastics.

TECHNICAL SALESMEN WANTED—Position open with large Midwest color manufacturer to head up color sales to the plastics and rubber industries. Must have some experience in the use of color in the plastics and rubber fields. Excellent opportunity for advancement in a new department. Reply Box 903, Modern Plastics.

WANTED—EXTRUSION ENGINEER to take complete charge of profile extrusion of acetate, butyrate, and styrene for company now engaged in elastomeric extrusions. Reply Box 936, Modern Plastics.

PLANT MANAGER WANTED—Must have experience in injection molding and molds. Small well established aggressive company, Boston area. Real opportunity. Reply fully. Box 933, Modern Plastics.

WANTED EXTRUDING ENGINEER—Large plastics company. Opening for man to take charge development work for extruding department. Reply Box 917, Modern Plastics.

WANTED BY ESTABLISHED chemical manufacturer in New York-Metropolitan area for newly created vinyl additives unit: a competent, experienced man to guide technical staff and introduce new products to vinyl processors. Our employees know of this advertisement. Reply Box 908 Modern Plastics.

ESTABLISHED MODERN NEW JERSEY compression molder satisfactorily operating own proprietary line requires Sales Manager for new custom molding division. Only those well connected with industry and industrial requirements should apply. Preference to experienced estimator capable of opening up National Distribution. Submit complete resume, qualifications, experience, and references. Confidential. Reply Box 932, Modern Plastics.

PLASTICS-FIBERGLASS ENGINEER to take charge of new department. Must have experience in compression moulding and be familiar with materials, tool and die designs, molding techniques, hydraulic pressure, preform equipment, etc. Permanent position with old established company. Salary open. Reply Box 935, Modern Plastics.

SALES ENGINEER with following among users of plastic bottles. Reply Box 918, Modern Plastics.

SITUATIONS WANTED

MANUFACTURING EXECUTIVE—specialized in molded fiber glass. Thorough knowledge of preforming and matched metal molding on production basis. Hand layups by a new process eliminating most hand finishing. Extruded fiber glass tubing. Experienced as factory manager, production manager, executive engineer in both large quantity production and high precision machine work. Well versed in all phases of shop practice, production control, estimating, cost accounting, cost analysis and purchasing. Desires position as manufacturing executive. Reply Box 912, Modern Plastics.

POLYETHYLENE EXPERIENCE—Extensive experience with extrusion of polyethylene flat sheeting, blown tubing, and related processing. Also, varied experience with extrusion of several other thermoplastics. Total of ten years in plastics development and production. Graduate engineer with chemical training. Only openings for positions at a responsible supervisory level will be considered. Married, with family, but willing to relocate. Reply Box 925, Modern Plastics.

GENERAL MANAGER: Executive-Engineer with a record of accomplishment in Injection Molding Plant operations. Strong background in Management, Product and Mold Design, Assembly and Finishing methods. Cost Reduction programs, Wage Incentives! Thorough knowledge of both Custom and Proprietary molding. Currently employed, seeking heavy management responsibility with progressive molding plant. Reply Box 921, Modern Plastics.

PRODUCTION SUPERVISOR: Thoroughly qualified to assume complete charge of manufacturing department from initial phase of production planning to final packaging. Nine years experience in secondary finishing and assembling of injection, compression and formed plastic products and toys. Wish to become associated with progressive firm having growth potential. Metropolitan New York and Northern New Jersey only. Reply Box 926, Modern Plastics.

POLYMERS-EXECUTIVE with broad experience in Polymerization, Processing, Product Development. Reply Box 920, Modern Plastics.

SALES AGENTS WANTED

WANTED—SALES AGENT: Vacuum Molder with press capacity 96"x40" also facilities for spray painting, silk screening, roll coating, electrical assemblies. Very low die and set up costs. We use wood, plaster, cast aluminum, or metal sprayed dies. We have a beautiful line of lighted one and two face signs. Plant located within fifty miles New York. VACUUM MOLDING, Boonton, New Jersey.

NYLON MOLDING—Rapidly expanding custom molder dealing exclusively in nylon requires representative in all major industrial areas on a commission basis. New plant and new equipment. Very excellent facilities for secondary operations. Reply Box 937, Modern Plastics.

SALES REPRESENTATIVE WANTED—LIQUID TYPE PHENOLIC AND UREA RESINS. (Solid Phenolics Also Available But Have Full Schedule) Will make commission or other suitable arrangement. Reply Box 905, Modern Plastics.

SERVICES OFFERED

DO YOU HAVE ONE OR MORE BOX MOLDS? If you do, it will pay to get in touch with us. We are one of the most progressive sales organizations in the east specializing in selling rigid plastic boxes to manufacturers for packaging their products. Non-exclusive arrangement satisfactory. Commission basis. Write OPPENHEIM COMPANY, 55 West 42 Street, New York 36, New York.

COMPETENT SALES EXECUTIVE with 15 years experience selling to radio, furniture and other industries offers aggressive coverage in Pennsylvania, Delaware, and Maryland to Compression Molder and/or other accounts that have a Specialized product or Service. Now handling injection and extrusion moldings. Commission basis. Reply Box 930, Modern Plastics.

MISCELLANEOUS

PATENT FOR SALE on low priced Envelope Moistener. This moistener has unlimited sales potentialities for commercial and home use; also advertising-premium and mail order. Construction; plastics, metal and rubber. Production and assembly cost is low and simple, and light for shipping. It is an ornament for any office desk or home. Write; PAUL, 327 West 28 St., New York 1.

PLASTIC EXTRUSION MANUFACTURER, 27 miles from New York City, equipped with extrusion and compounding equipment, desires working partner, small investment, replies will be treated with utmost confidence. Reply Box 911, Modern Plastics.

FOR SALE: ACETATE, white, ivory, pink pastels, red, blue and green, at 28¢ per pound, F.O.B. New York, regular supply. Odd colors 23¢.
16 OUNCE IMPCO Injection Machine, without press, $5000.00.
THREE STEEL MOLDS for complete Baby Toilet Seat—$2500.00.
WANTED: a 350 ton Toggle Press.
PEERLESS CHEMICAL CORP.
181 Greene Street, N. Y. C. 12.

FOR SALE: Going Transparent Plastic Fabricating Business in New England. Complete facilities for forming and cutting Royalite, Acetate, Vinyl, Styrenes, etc. Wonderful opportunity. Price $18,000.00. Reply Box 907, Modern Plastics.

POLYESTER RESINS—TOLL BASIS: Plant equipped produce substantial volume located on Eastern Seaboard with bulk tankage facilities and railroad siding interested manufacturing on toll basis. Reply Box 909, Modern Plastics.

U. S. TOY MANUFACTURER having molds on proven successful items wishes to associate with Canadian molder who has distribution in the toy field. Reply Box 910, Modern Plastics.

All classified advertisements payable in advance of publication

Closing date: 28th of the second preceding month, e.g., August 28th for October issue.

Up to 60 words $10.00	Up to 120 words $20.00	Up to 180 words $30.00
Up to 60 words (boxed) $20.00	Up to 120 words (boxed) $40.00	Up to 180 words (boxed) $60.00

For further information address Classified Advertising Department,
Modern Plastics, 575 Madison Avenue, N. Y. 22, N. Y.

VINYL PLASTISOLS

MICCROSOL, a product of Michigan Chrome & Chemical Company, is a true vinyl plastisol which can be readily adapted, through special formulation, to meet the strictest requirements for: dipping, casting, slush molding, etc.

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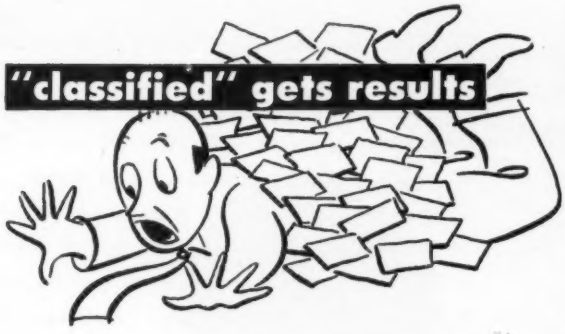
INDEX OF ADVERTISERS

SEPTEMBER 1953

MODERN PLASTICS

575 MADISON AVENUE • NEW YORK 22, N.Y.



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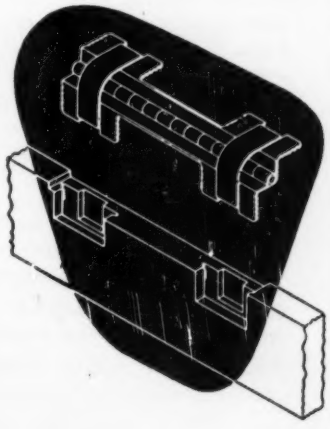

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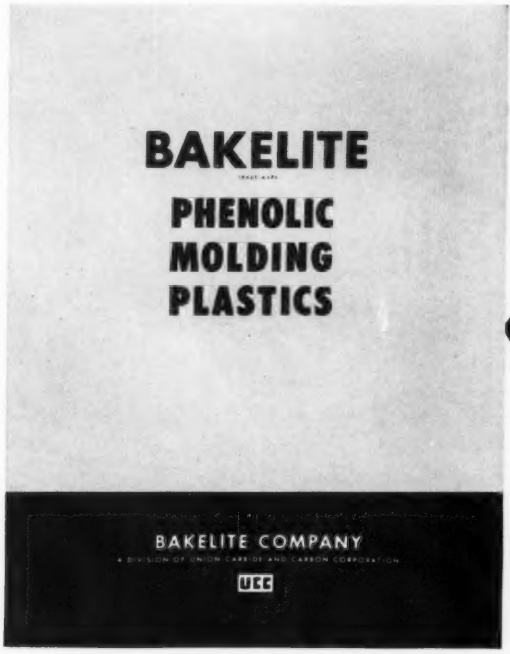

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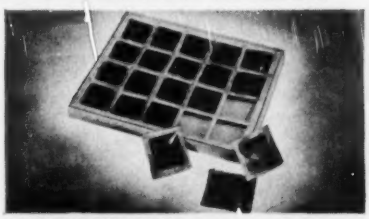

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